

Ambix

Being the Journal of the Society for the
Study of Alchemy and Early Chemistry

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VOL. V

OCTOBER. 1956

Nos. 3 & 4

OBITUARY.

FRANK SHERWOOD TAYLOR (1897-1956).

It is with deep regret that we record the death of Dr. F. Sherwood Taylor, who died on 5 January 1956 at the comparatively early age of 58. His loss will be felt by all those engaged in the study of the history of science, and particularly by members of the Society for the Study of Alchemy and Early Chemistry, for he edited AMBIX from its inception in 1937 until the time of his death.

Sherwood Taylor was born on 26 November 1897, and was educated at Sherborne School and Lincoln College, Oxford, where he won a scholarship in classics. He did not, however, read classics at the University but turned to science instead, and later obtained the degree of Ph.D. at the University of London for a thesis on Greek alchemy and alchemists. From 1921 to 1933 he taught chemistry at various public schools, and from 1933 to 1938 was assistant lecturer in inorganic chemistry at Queen Mary College, University of London.

When Dr. R. T. Gunther, the first curator of the Museum of the History of Science at Oxford, died in 1940, Sherwood Taylor was elected as his successor, and in spite of war-time difficulties at once began to prepare the Old Ashmolean Building to accommodate the Museum objects as soon as peace should be restored. Meanwhile he arranged in the basement of the Building a temporary display of the Museum's collections on a reduced scale, and this was opened to the public in 1941. Important accessions, such as the Clay

collection of historical microscopes and the famous Graham and Tompion Orrery, were procured, but it was only after the end of the war that Sherwood Taylor's plans for putting the Museum to full use came to fruition. New rooms were fitted up for the display of various collections, and the material stored or hidden during the war was expertly rearranged. In October 1949 the Museum was officially reopened to the public. Only a year after the completion of this laborious task, Sherwood Taylor was appointed Director of the Science Museum at South Kensington, London. Although he enjoyed the wider scope thus afforded to his exceptional abilities, he often looked back with marked regret to the quieter atmosphere of Oxford. His research work now had to take second place ; he often felt overburdened with administrative work ; and it was not very long before the strain began to tell. However he still continued to write books and articles, his very attractive 'Illustrated History of Science' appearing only a short while before his death. Earlier he had been a prolific writer of books on chemistry, the history of science, and the relationship between science and religion.

Sherwood Taylor became attracted to the study of alchemy through his enthusiasm for such poetical mystics as Jan de Ruysbroek, Thomas Vaughan, and William Blake. It was a fortunate attraction, for his combination of chemical, classical, and mystical knowledge enabled him to throw much light on alchemical obscurity ; his studies on Greek alchemy are well known and of special interest. His varied erudition was of course of the greatest possible value in the exacting and intricate task of editing AMBIX, for the success of which his scholarship, judgment, and unremitting labour were largely responsible. He did not lack the firmness requisite in an editor, but his willingness to listen to the views of others, and his modest and unassuming manner, smoothed the difficulties that inevitably arise from time to time during the publication of a highly specialized journal.

Sherwood Taylor's great gifts of mind were accompanied by a deep sincerity and an unswerving loyalty to his friends. Nor was it his intimates alone who could turn to him for help and advice, always unstintingly given, whether he was consulted on points of scholarship or on practical affairs. His interest in AMBIX continued to the end ; he was actively instrumental in founding the journal, and its pages provide a fitting and lasting tribute to his memory.

E. J. HOLMYARD.

AN ALCHEMICAL WORK OF SIR ISAAC NEWTON.

By F. SHERWOOD TAYLOR.

PART I. INTRODUCTION.

A VALUABLE estimate of Sir Isaac Newton's concern with alchemy has been given by R. J. Forbes¹ but, as this author himself suggests, a definitive account of Newton's dealings with alchemy could be given only after a study of the voluminous alchemical manuscripts written or owned by him. Before proceeding to an account of these it may, however, be of use to make a preliminary and external survey of the evidence for Newton's interest in this subject, and the amount of time that he devoted to it.

Newton published nothing on alchemy, nor does he allude to it explicitly in any of his published works.

It was known, however, in his lifetime that he carried out alchemical experiments, and his status as an alchemist has been somewhat reluctantly recognised.

It is clear that Newton concerned himself with chemical matters at an early age. Thus an interest in chemistry appears in recipes for pigments and medicines, recorded in a notebook written when he was seventeen.² In his letter to Aston, dated May 18th 1669, he propounds general heads for his friend's inquiries during an intended trip to the Continent, and among other topics he mentions metallurgical practices, leading to transformation of iron into copper, and mercury into silver³. In his early years at Cambridge (1669) he bought 'glasses' and also aqua fortis, sublimate, oyle pink, fine silver, antimony, vinegar, spirit of wine, white lead, salt of tartar, and two furnaces, all of which cost him £2 15s. 0d. He also bought the *Theatrum Chemicum* for £1 8s. 0d.⁴.

In 1675, Newton was described by Collins as 'intent upon chemical studies and practices, and both he and Dr. Barrow beginning to think mathematical speculations to grow at least dry, if not somewhat barren.' In 1691/2 Newton writes to Locke concerning a 'process about the red earth and mercury' communicated to the latter by 'Mr. Boyle' and a considerable discussion followed. In Newton's further letter of August 2nd 1692, he declares his belief that it was for the sake of this recipe that Boyle procured the repeal of the Act of Parliament against Multipliers. In 1695, Newton records conversations

¹ Forbes, R. J. 'Was Newton an Alchemist?' *Chymia*. Vol. II, p. 27, 1949.

² More L. T. *Isaac Newton*. New York and London. 1934, p. 18.

³ *Ibid.*, p. 54.

⁴ *Ibid.*, pp. 50-1.

on alchemical subjects with 'a Londoner' acquainted with Mr. Boyle and Mr. Dickinson⁵. The inventory of his goods⁶ discloses 'a parcel of chymical glasses' as a part of his effects, and we may think that his chemical interests continued till the end of his life.

His collection of books has been described by de Villamil, whose lists disclose a total of 175 alchemical books constituting about a tenth of Newton's library. It is, therefore, quite clear that alchemy played an important part in Newton's philosophy of life.

Newton's Alchemical MSS.

The most important source of knowledge concerning Newton's alchemical interests is to be found in the mass of papers on the subject, mostly in his handwriting, that have survived. After Newton's death, his papers were kept by John Conduitt who had married Newton's niece, Catherine Barton. Conduitt's daughter became Viscountess Lymington, whose son was the second Earl of Portsmouth, and the papers remained with the Lymington family. A part of these papers was given to the University of Cambridge⁷, but the alchemical MSS, amounting to about 650,000 words, remained in the family until 1936, when they were sold at auction by Messrs. Sotheby, whose *Catalogue of the Newton Papers* (1936) forms the best record of their contents.

The largest single collection of these is possessed by King's College, Cambridge, to which they were presented by John Maynard Keynes, who bid for some of them at the Lymington Sale, and bought others at a later date. I would here record my gratitude to the President and Fellows of King's College, who have generously made these papers available to me. The King's College MSS concerned with the alchemical work of Newton are 55 in number, of length varying from a thousand to twenty-five thousand words. The great majority are in Newton's own hand, and are written on quires of paper folded in the form of a book. Since some are uncut, Newton would seem to have written each page in the correct position on the unfolded sheet, and then folded it.

The King's College MSS may be classified as follows.

- (1) Transcriptions of alchemical books or MSS.
- (2) Epitomes of alchemical treatises or parts thereof with or without Newton's notes.
- (3) *Indices Chemici* and Lists of Authors.
- (4) Alchemical treatises, complete or incomplete, written or compiled by Newton himself. Of the last class is the *Sententiae Notabiles* printed on p. 64 *et seq.* of this journal.

⁵ King's College MS. 26. Sotheby's *Catalogue of the Newton Papers*. Lot 30.

⁶ de Villamil, R. *Newton : The Man*. London, 1932, p. 50.

⁷ *A Catalogue of the Portsmouth Collection of Books and Papers written by or belonging to Sir Isaac Newton, the scientific portion of which has been presented by the Earl of Portsmouth to the University of Cambridge*. Cambridge, 1888.

Extent of Newton's alchemical studies.

That Newton was studying alchemy over a long period has already been demonstrated, and is confirmed by a preliminary survey of these MSS some of which are of dates as early as 1676, and others as late as 1696.

These MSS, moreover, afford us the means of estimating the extent of Newton's reading on the subject. Thus he gives extensive lists of alchemical authors and texts. We are not thereby assured that he had read all the works he lists, nor can we even be sure that he had read all the books in his library, but since he does cite or refer to about 75 alchemical books in the King's College MSS, it is reasonable to suppose that he had read these, and quite certain that he had read those of them which he epitomises or from which he quotes long passages.

These alchemical works are cited by the abbreviated titles which I have reproduced below. Since Newton usually gives page-references, it is possible in most cases to identify not only the work, but the edition he used: some of these are so identified in the notes printed at the end of this paper.

Some Alchemical works as cited by Newton.

- Abraham Judaeus.
- Aegidius de Vadis.
- Alexander in Artis Auriferae.
- Allegor. in Turba.
- Anonym. in Artis Auriferae.
- Arcan. Arcanorum.
- Arcan. Hermet.
- Aristot.
- Artephius.
- Avicenna. Tractatulus.
- Aureum Saeculum Redivivum.
- Bacho, de Mirab. Potest.
- Basilius, 12 Keys.
- Basilius, Triumphal Chariot.
- Bernardus.
- Bibliotheca Gallica.
- Bloomfield's Blossoms.
- Chaucer.
- Clangor.
- Collectanea Chymica.
- Concordantia Raymundi et Guydonis.
- Consil. Conjug.
- Dav. Lagneus.
- Dunstan.
- Edwardus Generosus.

Efferar. Monach.
Epist. Com. Trevisani ad Thom Bonon.
Faber. Hydrogr. Spagyrr.
Flammel.
Georgii Riplaei. Canonici Angli. opera.
Golden Calf.
Grasseus.
Hermes Apud Seniorem.
Isaac Hollandus.
Jodocus a Rehe.
John Pontanus.
Manna.
Maier, Atalanta Fugiens.
— Lusus Serius.
— Septimana Philosophica.
— Symbola aureae.
— Viatorium.
Margarita Prec.
Marrow of Alchemy.
Morien.
Norton, Tho.
Nov. Lum.
Ortus Medicinae.
Philaletha. Brevis Manuductio.
Philaletha. Comment. in Ripl. Epist.
— Comment. on Ripley's Gates.
— De Metallorum Metamorphose.
— Fons Chemicae Philosophiae.
— Secrets Revealed.
Richard Carpenter.
Rosarium Magnum.
Rosar. Philos.
Rosin.
Ripley. Bosome Book.
Ripley's Preface.
Richardus. Correct. Fal.
Robertus Vallensis.
St. Didier. 6 Keys.
Semita Semitae.
Sendivogius. Trac.
— Aenigma.
Senior.
Snyders de Pharmaco Catholico.

Theatrum Chemicum
Theodorus Mundanus
Trevisan. Epist.
Triumph. Hermet.
Turba.

Alchemical ideas in Newton's scientific thought.

At one point at least, alchemy fitted into Newton's cosmology. He was convinced of the need for a universal medium which should explain gravitation, electrical and magnetic forces, and animal motion. The explanation of all these, in terms of various aethereal substances, was natural enough to any man of the age ; and a great part of alchemy is concerned with that universal medium, the philosopher's mercury. We cannot but hear the voice of Alchemy in those famous words " Nature is a perpetual circulatory worker, generating fluids out of solids, and solids out of fluids, fixed things out of volatile, and volatile out of fixed, subtile out of gross and gross out of subtile, some things to ascend and make the upper terrestrial juices, rivers, and the atmosphere, and, by consequence, others to descend for a requital to the former, and as the earth, so perhaps may the sun imbibe this spirit copiously to conserve his shining, and keep the planets from receding further from him.⁸" In a letter to Oldenburg, he clearly makes this circulation responsible for gravitation, the sticky particles of aether entering the great bodies, carrying with them the lesser bodies that descend towards them.

Newton an Alchemist.

Even a preliminary perusal of Newton's alchemical papers will leave no doubt in any mind familiar with alchemical literature, that Newton was in the fullest sense an alchemist. He conducted alchemical experiments, he read widely and universally in alchemical treatises of all types, and he wrote alchemy, not like Newton, but like an alchemist. His method was the standard one of minute study and comparison of the works of the alchemical masters ; and his works are, in their turn, a succession of extracts from earlier authors, with a few of his own comments thereon, and even these are in conventional alchemical language. That Newton spent his great powers freely upon alchemy is not in doubt : we would have hoped to find in his writings, evidence of a great mind elucidating the obscurity and ordering the apparent chaos of alchemical texts. But either the truth about alchemy evaded Newton, or Newton's contribution to the subject evades us, which is very possible, for no one to-day can assess the fine points of alchemical conjecture. It has been suggested that Newton was interested in alchemy merely as a branch of metallurgy, but this is not borne out by his reading or writing. It seems more likely that Newton was interested

⁸ Brewster, Sir David. *Life of Sir Isaac Newton.* 1831, 1, p. 390, ff.

in alchemy as a sort of fundamental chemistry. There is not much to make us suppose that he was expecting to enrich himself with gold : there is nothing to make us think that he was treating the texts as mystical treatises. He seems to have been seeking in the texts with their pictures and emblems, chemical principles which could be realised in the laboratory, and he seems to accept without question the alchemical view of the world. It is indeed scarcely possible to believe that the man who wrote the *Sententiae Notabiles*, printed in this paper, did not believe in the alchemical set-up of the four elements, the philosopher's mercury and so on. It is true that very little of that text was originated by Newton, but it is equally true that he produced it by selecting as noteworthy particular passages out of treatises amounting to hundreds of thousands of words, and his very selection of them affirms his opinion of their value, and so of their truth. Newton's notes on alchemical texts are elucidatory and never sceptical ; accordingly I believe that the Newtonian alchemical MSS fully bear out the hypothesis that Isaac Newton was in the fullest sense an alchemist.*

PART II.

SENTENTIAE NOTABILES.

This text forms part of King's College MS 38 (Lot 58 at the Lymington Sale). With a shorter work *Notanda Chemica* it is contained in a notebook (much of which is blank) with marbled paper wrappers. The whole of the work is in Newton's hand. It is drawn from his favourite authors, and the subjects he discusses are discussed in other papers in his hand. There is no reason whatever to suppose that it is not his own production.

The manuscript is not dated, but the mention of *Collectanea Chymica* as having been published in 1686, shows the work was not completed at an earlier date than this.

Sententiae Notabiles.

Viridis et vegetabilis nostri argenti vivi substantia est Basilisci Philosophici pabulum. Theodor. Mundan.⁹ p. 180. Vide etiam p. 70 et 194. An non hoc intelligendum [sic] sit de multiplicatione $\frac{1}{4}$ ^{is} fixi rubri per tria principia ?

* Additional confirmation of the late author's hypothesis is also suggested by the phraseology of Newton's only independently published chemical paper *De natura acidorum*, which was written about 1692 and first appeared in John Harris's *Lexicon Technicum*, 1710. As notice of this publication of Newton has been omitted, it was thought fit to mention it here. (Editor)

⁹ The work referred to is : Epistola Edmundi Dickinson, M.D. & Medici Regii ad Theodorum Mundanum Philosophum adeptum, De quintessentia Philosophorum et De Vera Physiologia, Una cum Quaestionibus aliquot de Secreta Materia Physica. His Accedunt Mundani responsa. Oxford, 1686. The work was in Newton's library, (Villamil p. 74).

Nam hoc dicit praeparatio lapidis animalis propter vapores noxios maxime cavenda.

Non solum animalis sed mineralis item vegetabilis materia noxios in praeparando vapores exhalat a quibus cavendum est.¹⁰ Th. Mundan. ib. p. 181.

Mercurius noster rebus omnibus inest, ex duabus salinis substantiis, ejusdem radicis producitur, omnium metallorum quibuscum miscetur et coquitur qualitates et proprietates in se recipit, est arida res sive ut Philosophi appellant sicca et coagulata salsae naturae aqua, est calidus et igneus, per coctionem et destillationem densior fit minusque fluxilis, et per destillationem in aquosum spiritum fixamque terram convertitur, in se habet candidissimum rubicundissimum fixum et incombustibile sulphur, producit et vivificat omnia vereque cunctorum est humidum radicale, in visceribus suis tum album tum rubrum salem educendum continet et realiter totus est sal a salinosa fonte profluens, est mercurii vulgaris et omnium metallorum semen, aurum et argentum radicibus solvit et cum solutis intime unitur ut fiat unicum individuum in perpetuum inseparabilis qua de causa vocatur aqua permanens: ob ejus principia quibus constat appellatur metallicus reipsa tamen non magis est talis quam vegetabilis et animalis est enim (ad instar ignis Pontani¹¹) aereus aqueus igneus terreus: Ex vulgari ♀^{io} per se aurum argentumque nullis artibus elicetur: Ex nostro in se tincturam tum albam tum rubram possidentem utrumque [sc. aurum et argentum] per operam pyrotechnicam conficitur: Seipsum dissolvit seipsum coagulat et absque ullo additamento per simplicem coctionem ad elixiris supereminentiam ascendit. Atque his proprietatibus ♀ noster a vulgari distinguitur. Theodor. Mund. p. 182.

Aeris volucris maris piscis terrae pecudes materiam lapidis tibi afferunt. Adamus illum in mundum secum tulit et moriens in sepulchrum suum duxit: nec vilissima mundi creatura nec ullum elementum hac ignea vacat essentia et hac subtili terra quae simul conjunctae viscidam et oleosam componunt aquam [siccam mercuriale praedictam] quae est materia nostri magisterii et mercurius noster dicitur. Latet in omnium concretorum centro et sine magna difficultate ex multis universi rebus vulgari destillatione extrahitur sicut oleum ex vegetabilibus et animalibus educitur. Estque homo ejusdem materia ditissima fodina nempe ejus urina et stercus. Luminosa autem substantia est, immo vero ignis per destillationem accendens. Necessarium tamen est ut artifex hanc igneam aquam manuali ac artificiosa operatione in metallico sulphuris conditionem reducat quod valde purificatum et omni faece cunctaque tum terrena tum aquosa redundantia liberatum auro inseparabiliter unietur ejusque tincturam dilatabit et multiplicabit. Nam iste mercurius Alchimiae non subservit

¹⁰ This paragraph is summarized from pp. 182-4 of *op. cit.* n.l.

¹¹ See Joannis Pontani, Summi Philosophi, Epistola de laſide Philosophorum in Opuscula quaedam Chemica Georgii Riplei Angli Medulla Philosophia Chemicæ. Frankfurti, MDCXIV. p. 148: or in Theatrum Chemicum, 1659. The passage assigns the epithets *aereus*, *aqueus*, *igneus*, *terreus*, to the Philosopher's Stone. The book is not known to have been in Newton's library.

quamdiu in vegetabili aut animali statu permanet quapropter hoc sulphur vel oleositas fieri debet metallicum quod effici non potest nisi apprime purum et unctuosum reddatur quod repetitis putrefactionibus, destillationibus, et separationibus exequatur Chemicus. His enim artibus ad summum puritatis et perfectionis gradum redigitur et tunc primum Philosophi opus ac primitiva materiae praeparatio expletur. Nisi vero ars elementa separandi bene intelligatur et nisi modus extrahendi aquam ex aere, aerem ex igne, et ignem e terra cognoscatur in chemia parum aut nihil efficies : Si vero istius artis sis peritus, nimirum dividendi quatuor elementa juxta sapientum doctrinam, facile eadem purificare valeas et proportione geometrica jungere illa eoque modo digerere ut viscidam igneum efficias aquam quae materia est de qua quaestionem instituis. Theodor Mundan. p. 174, 175, 176.

Quomodo vero elementa post duas putrefactiones materiae mineralis separanda sunt et iterum jungenda digerenda et sublimanda ut habeatur primo Diana nostra et sal ammoniacum et sulphur album naturae dein liquor Alkahesticus a Theodoro Mundano fuse describitur p. 197 & sequ.

Dicit etiam quod oleositas quae in animalibus et vegetabilibus latet, reperitur etiam in liquoribus corrosivis : et inde fit ut liquoris isti adaugeant tincturam auri in se soluti et opus abbreviant. pag. 177¹².

Agens primum philosophicum quod solum est vera artis Alchemiae clavis est ♀ summe volatilis penetrantissimus vivus et vivificus, aqua illa sicca a Philosophis toties descripta, fluens labilis et tamen manus tangentis non madefaciens nec aliud quicquam quod de unitate suae materiae non sit. Est custos noster portenarius, balsamum nostrum, oleum, mel, urina nostra, ros maii, femella, mater, ovum, furnus secretus, Clibanus, cibrum, marmor, ignis verus, Draco venenosus, Theriaca nostra, Vinum ardens, Leo viridis, Avis Hermetis, Anser Hermogenis anceps gladius in manu Cherub, qui viam arboris vitae tuetur, vas nostrum verum occultum, hortus item philosophicus in quo sol noster orietur. Regalis est mineralis, triumphans saturnia vegetabilis, mercurii item caduceus quocum mira operatur seque pro lubitu suo transformat ut varias larvas induat. De hac aqua Philosophus : *Glorientur inquit, Alchemista utut volunt, at sine hac impossibilis est est metallorum transmutatio.* Accipe quod de se est immundissimum, hoc est mulier nostra meretrix : expurga penitus omnes sordes et extrahe inde quod est purissimum ; hoc est menstruum nostrum, Diadema regale.¹³ Hoc est agens homogeneum, mercuriale, ponticum, purum,

¹² The preceding matter is all to be found in *op. cit.*, n. 9.

¹³ The first sentence of this paragraph is summarised, and the whole of the rest transcribed from Chapter VII of the *Ars Metallorum Metamorpheos* of Philalethes. Newton used the edition of Martin Birrius, who ascribes the treatises contained in it to an ' unknown author '. In later editions, such as that of the *Musaeum Hermeticum*, the treatises are ascribed to Philalethes.

The title of the work is *Tres tractatus de Metallorum Transmutatione. Quid singulis continetur sequens pagina indicat. Incognito Auctore. . . Quae omnia ad bonum publicum promovendum nunc primum in lucem edi curavit Martinus Birrius . . . Amstelodami. 1668.*

mundum, crystallinum sine diaphaneitate, liquidum sine humectatione¹⁴. Per hoc agens educitur auri sperma, quod cum appareat, sub mercuriali forma egreditur, deinde exaltatur in essentiam quintam albam primo deinde rubeam per ignem decoquenter continuum. Requiritur enim ad opus nostrum non dissolutio quaevis sed philosophica id est in aquam mercurialem per praeviam calcinationem per ♀ agentem facta, quae per subtilem elementorum rotationem ac conversionem producitur : quae calcinatio est humidi homogenei cum sicco suae naturae mortificatio ut postea per idem humidum siccum vivificetur in tantum quod digestissima virtus ex dissolvendo per dissolvens extracta, hujus calcinationis atque dissolutionis causa sit¹⁵. Haec Philalethes¹⁶ (cap. 6 et 7 Metal. Metamorph.) de menstruo quod per primam putrefactionem ex chao paratur, per quod aurum calcinatur et calcinatum imbibitur ac dissolvitur : dein cap. 8 docet quomodo ♀ vulgi per hunc ejus caduceum fermentari debet et opus ingredi. Norint, inquit, doctrinae filii materiam ingredi debere ac posse quamlibet non totam quae in isto conspicitur substantiam. Pro certo namque cognoscant Chemicolae ingeniosi nullum alium dari mercurium ex quo omnia metalla quam vulgarem, qui generatus intra venas terrae, quamdiu a crudo aere tutus mansit in loco ad generationem apto, ad metallum procreandum penitus destinatus est casa autem aliquo vitiata loci aptitudine materia haec statim (instar ovi refrigerati) quasi mortis malleo perculta motum omnem penitus amisit. Haec est materia vera cui forma ♀ ii philosophica deest. Ab hac forma dupli respectu distat, primo ejus quod secum retinet superflui, secundo ejus quod in isto deficit, virtutis spiritualis. Superfluitas duplex est, terrena lepra et aquea hydrops, defectus autem est caloris sulphurei veri cuius additamentum omne superfluum penitus expurgabit. Adde itaque ♀ io quod deest, nempe vim igneam ad urendum et a mercurio sponte decident omnes faeces, quas tu exquisite separabis. *Jupiter* tum adeptus est imperium et discussis cellerrimis *Saturni* nubeculis fontem tibi pellucidum coruscantemque emergere fecit. Hic mercurius aurum naturaliter dissolvit solutione vera philosophica ; sed et aurum (NB) atque argentum de se naturaliter producit, arcanum item auri potabilis. Hactenus Philalethes¹⁷ qui et Fonte Chem. Philos. pag. 99 haec addit : Aurum [vulgi] est corpus calidum et siccum, Luna [nra] frigida et humida Mercurius medium deferendi tinturas. Corpus solis est digestissimum, Lunae imperfectum et immaturum, Mercurius vinculum quocum duo haec contraria uniuntur. Junge Lunam Mercurio cum ignitione debita et conveniente et ita misce ut Luna cum ♀ fiat unus ♀^{us} ignem in se retinens & decident a ♀ omnes faeces et superfluitas et fiet clarus tamquam oculi lachryma licet non diaphanus : tum demum cum auro commisce hunc

¹⁴ Taken from the latter part of the chapter named in n. 13.

¹⁵ Taken from Chapter VI of *op. cit.* n. 11.

¹⁶ *Op. cit.*, n. 13.

¹⁷ The passage beginning ' Pro certo namque ' is partly summarized, and partly copied from Chap. VIII of *op. cit.*, n. 13.

ꝝ in quo est Luna et ignis et tum calidum et siccum amabit frigidum et humidum¹⁸—Nam corpus solis nunquam conjungetur cum mercurio per intima nisi mediante Luna seu corpore imperfecto et igne: et haec Luna est succus aquae vitae quae latet in mercurio qui cum igne est acuatus et est spiritus intrans corpus et illud alterans et cogens illud retinere animam. Iam vides quali de ꝝ¹⁹ hactenus locuti sumus non vulgari sed pluviali qui proprie dictus non est Mercurius sed aqua ꝝ ialis. Mercurius enim vulgi est aqua sed deest ei spiritus et vis ignea ad urendum. Supple si potes quod deest summo cum artificio, tum non amplius erit ꝝ vulgi sed similis nostro.²⁰—rejectis scilicet faecibus per sublimationem, quam Philosophi primam materiae tenuis preparationem appellant per quam Eclipsis terrenae interpositionis tollitur ut possit illuminationem a sole accipere: quod fit cum fusca sphaera Saturni quae totum obnubilat horizontem deletur. Tum Jove imperium obtinente ascendit in aerem nebula splendidissima etc. Haec est *veterum Philosophorum* materia quam accipere debemus, quae ut dicit Auctor Novi Luminis²¹ est sed non appetet donec artifici placet in qua cognoscenda tota latet perfectio, estque menstruum nostrum et mercurius, occidens et ager noster philosophicus in quo sol oritur. Haec Philalethes²², ex quibus liquet hunc ꝝ^m esse aerem quem Sendivogius dicit esse veterum philosophorum materiam et non apparere donec Artifici placet, nec non in decuplo esse ad unam corporis partem, et cuius preparationem (habito prius ꝝⁱⁱ caduceo) ipse in Tract. 11 Philalethes in Comment in Riplaei Port 1²², et Abrahamus Judaeus in hieroglyphica prima describunt. Haec est aqua salis petrae quae in manifesto est quasi mercurius at in corde purus ignis infernus. Lurido vultu Alchemistarum vulgus aspicit unde factum quod illum vilipendant, doctrinae vero filios splendore suo stupefacit. Est aqua nostra vere pontica serena crystallina pura munda, mare nostrum, fons noster occultus ex quo aurum naturaliter creatum est, cum tamen se praferat auro et vincat illud et in hora suae nativitatis aurum cum illo jungitur et in eo lavatur et utrumque crescunt in heroem fortem. Nam per hanc aquam solam absque alio labore (nisi corporis perfecti mundi limati additione) lapidem nostrum perficies. Est ignis ille qui mori pariter et vivere facit de quo scripsit doctus ille vir Joannes Pontanus quem qui semel adeptus est ad autumnum sui laboris pervenit. Nam addito corpore mundo justa quantitate, caetera cuncta a

¹⁸ Transcribed from *op. cit.*, n. 13, p. 99.

¹⁹ *Ibid.*, pp. 103–104.

²⁰ So in Philalethes.

²¹ Quoted from *op. cit.* n. 13, p. 108.

²² The work referred to seems to be *A Breviary of Alchemy, or a Commentary upon Sir George Ripley's Recapitulation, being a Paraphrastical Epitome of his Twelve Gates*. Written by Aeyrenaeus Philalethes Anglus Cosmopolita. London, 1678. This treatise is contained in the work *Ripley Reviv'd or an Exposition upon Sir George Ripley's Hermetico-Poetical Works—written by Eirenaeus Philalethes . . .* London, 1678. This book was in Newton's library. The exact passage referred to is uncertain, perhaps pp. 12–14.

natura perficiuntur. Dissolvet enim et coagulabit, calcinabit et putrefaciet et omnia perficiet regimina successive unum post aliud usque ad complementum perfectum. Duplicem vero alium habemus ignem quem tu facile cognoscetis quam cito hunc primum didicisti. Componitur ex vase et igne Philosophorum quibus tertium additur nempe vinculum seu furnus utramque continens et conjungens. Haec Philalethes in *Fonte Chem. Philos.*²³ p. 90, 92, 93. Idem in *Breve manuductione*²⁴ pag. 66 & 67. Haec aqua, ait, est viva currens clara nitida albissima instar nivis, calida humidaque aerea vaporosa et digerens in qua aurum liquefit ut glacies in aqua tepida. In ea continetur totum ignis regimen et $\frac{1}{4}$ quod non dominatur. Est custos portenarius balneum Regis et Reginae assidue calefaciens et tamen aliunde sumitur quam a materia et a substantia aquae albificante est distincta, conjuncta tamen et sub eadem forma fluxus eodemque calore apparet. Hic est calor lampadis qui si temperatus sit quotidie circumaget materiam usque dum exiccata per calcinationem humiditate *ignis* secundus cinerum producitur in quibus vas sive aqua hermetice clauditur et sigillatur secundum philosophi dictum. Accipe vas, percute gladio, animam ejus accipe, haec est clausura. Est itaque aqua haec nostra. Vas nostrum in eaque occulte habitat furnus noster, cuius ignitio oportet ut sit moderata ne totum opus destruatur, satis tamen validane ob coloris defectum desponeat animus. In hujus aquae cognitione omnes nostri ignes omnia pondera cuncta regimina latent. Haec aqua est fons ille clarus pellucidus in quo lavandus est rex noster ut omnes suos inimicos vincere valeat. De hac aqua et ejus praeparatione esto sollicitus quia certi absque ullo alio adminiculo nisi per corporis perfecti purgati et limati appositionem Natura ex hac lapidem nostrum secretissimum efficit. Est alba tepida limpidaque et clavis totius artis quacum omnia secretissima Philosophorum reserares. In ea facienda maximus est foetor, ffit autem Lapis noster ex una re et quatuor substantiis mercurialibus (ex quibus una est matura [viz. aurum] caeterae crudae purae, quarum duae [ignis et furnu] sunt per tertium ex minera tractae, modo tamen miro) junctis igne temperato non violento atque ita quotidie coctis usque dum ex omnibus fiat unum naturali conjunctione secretissima non manuali. Postea mutata ignis qualitate digeratur igne indies crescente, usque dum figurantur haec volatilia.²⁵

Si artis sis peritus dividendi quatuor elementa, facile eadem purificare valeas et proportione geometrica jungere, eoque modo digerere ut viscidam igneam efficias aquam quae est materia nostri lapidis (*Mundanus*²⁶ p. 74, 75). Hic est noster mercurius ex duabus salinis ejusdem radicis substantiis arte nostra productus. Est arida res seu ut Philosophi loquuntur sicca et coagulata

²³ Extracted from *op. cit.* n. 13.

²⁴ *Ibid.* (*Brevis Manuductio etc.*).

²⁵ Copied and summarized, *Ibid.*

²⁶ Newton's page reference (to *op. cit.*, n. 9) should be 174, 175.

salsae naturae aqua, et mineralium singulorum cum quibus miscetur naturam admittit. Per coctionem et destillationem fit densior minusque fluxilis et per lenem destillationem *in aquosum spiritum fixamque terram* convertitur. Habet in se candidissimum rubicundissimum fixum et incombustibile sulphur. Et in visceribus suis tum *album* tum *rubrum* *salem* continet et realiter totus est sal a salino fonte profluens. Est mineralis vegetabilis et animalis, aereus, igneus, terreus. Est metallorum omnium semen solvens universalis et aqua permanens. Aurum et argentum ex eo conficiuntur, nam per se tincturam tum *albam* tum *rubram* possidet. Se ipsum solvit, se ipsum coagulat, et absque ullo additamento per simplicem coctionem ad Elixir supereminentiam ascendit veraeque sophorum veterum tincturae (ib.²⁷ p. 182, 183, 184, 185). De sale hocce pingui si magnum Elixir efficeres, aut metallorum et hominum medicinam, necesse est ut prius illum in substantiam *oleo homogeneo similem* [sc. per ulteriore imbitionem] convertares: deinde postquam corpus hoc luminosum *putrefecisti* opus est ut in *humores quatuor permutebor* denique humores isti in purum sulphur transmutandi sunt, sulphur scilicet cuius humiditas in igne crescit fitque coctior et maturior mercurius. Noster enim ♂ seu aurum et ♀ sunt una eademque res (ib.²⁸ p. 187). Aurum argentumque nostrum unguinosae ac liquidae sunt substantiae, ambo eodem corpora quo latebant extracta, cruda et imperfecta a natura illic reicta; cum vero ab arte extracta purificata et concocta, millies efficaciora et potentiora fiunt quam vulgare aurum fieri usquam potest. Nam aurum vulgi mortuum est et ad altiorem perfectionis gradum assurgere non potest nisi prius ad *primogeniam et crudam conditionem reducatur vel ad auri nostri naturam*²⁹; quae est humida substantia aperta, viridis vitalis, et vegetativae potestatis et apta ut altius altiusque exaltetur in immensum. Absque tali auro verum aurum potabile confici non potest. Materia autem ex quo hoc *sal aureum* seu aurum elementale effoditur Philosophorum Mons appellatur, (ib.³⁰ p. 188, 189, 190, 191, 192). Triplex est aurum astrale elementarium et Metallicum. Astrale est purum et igneum sal [Elixir perfectum] quod sol radiis suis in astris producit, vehiturque cum astrorum effluviis per totum firmamentum. Elementarium est sal purum et fixum in quovis corpore Metallicum est aurum vulgi quod ab avaris plusquam a Philosophis diligitur. Nam quamvis hoc aurum aperire possunt et crudum reddere ut operis sui materia fiat, semper tamen altera duo genera praecipue ambiebant tamquam subjecta suis operationibus aptiora et stupendorum effectuum auro communi capaciora. (ib.³¹ p. 188, 189).

²⁷ I.e., *op. cit.*, n. 9. The matter is transcribed from the pages cited.

²⁸ *Ibid.*, p. 187, copied with minor modifications.

²⁹ The underlining is Newton's.

³⁰ The preceding passage is chiefly from pp. 188–190 of *op. cit.*, n. 9.

³¹ *Ibid.*, 188–9, slightly summarized.

Our fountain hath three springs, the spirit, the watre and the blood. The water is a mercurial bond, the spirit wch is the wonder of wonders appears to y^e world in a vile compact form and is so useful in humane affairs that none can want it. To the Philosopher it appears united to y^e blood of y^e Green Lyon, wch is not till then a Lyon, but is thereby made able to devour all things of its kind. Yet are they not radically united, ffor y^e spirit is separable from y^e water and blood [after putrefaction] and then is y^e Lyon actually green [in colour] but ceases then to be a Lyon, but is y^e true matter to multiply Emeraulds more glorious then those of y^e mine. Phil. in Ripl. Gat. p. 29, 30.³²

And Mundanus in cautioning against the most noxious fumes of the animal mercury saith, *Viridis et vegetabilis nostri argenti vivi substantia et Basilisci philosophici pabulum* (pag. 180, 181)³³ viz. the white and red spirits and fixt salt in this ♀ are ye milk and bread wherewth ye infant or animal stone is fed and multiplied to perform miraculous effects.³⁴

Hence Flammel places y^e body soul and spirit in a green field and Rosarium pag. 143. *Aes est aurum nostrum a vulgari diversum.* Putas aes esse corpus leprosum propter viriditatem suam, sed totum quod est perfectum in aere est ipsius sola viridas, quippe quae per nostrum magisterium cito vertitur in aurum nostram verissimum, et hoc experti sumus. Nullo tamen modo poteris lapidem praeparare absque Duenech viridi et liquido quod in mineris nostris nasci videtur. O benedicta viridas etc. Scilicet ubi spiritus qui fixionem maxime impediret, calore leni separatur, anima et corpus simul operantur et propter defectum humoris et fixitatem ejus, cito coagulantur in aurum nostrum, quod est sal rubeum. Sic Rex Duenech atra bile tumens in balneum Laconicum i.e. vaporosum et sudoriferum introducitur ut ibi sudet. Maier Embl.³⁵

The tincture is a powder of a colour most red, almost like saffron, yet its whole corporal substance is liquid as Rosin, perspicuous as crystal, brittle as glass, of y^e colour of a Ruby, and exceeding ponderous. Paracelsus in y^e Golden Calf³⁶ p. 30.

Tis a shining carbuncle clear as crystal, compact and most ponderous, as fluid in fire as Rosin and before the flight of Mercury, as wax flowing yet wthout

³² The paragraph is a much-shortened, but almost verbatim version of pp. 28, 29, 30, of *An Exposition upon Sir George Ripley's Vision, written by Aeyrenaeus Philalethes Anglus Cosmopolita*. London, 1678, printed as part of the work cited at the end of n. 22.

³³ *Op. cit.*, n. 9.

³⁴ This seemss to be one of Newton's few comments.

³⁵ The reference is to Michael Maier's *Atalanta Fugiens, hoc est, Emblemata Nova de Secretis Naturae Chymica*. Emblema XXVIII, p. 121. Newton had many of Maier's works in his library, but the *Atalanta Fugiens* is not recorded among them.

³⁶ The title of the edition used was *The Golden Calf which the World adores and Desires . . . Written in Latin by John Frederick Helvetius . . . and faithfully Englished*. London, 1670. The passage is taken verbatim from the top of page 30. The book was in Newton's library.

fume, entring and penetrating solid and close bodies as Oyle doth paper, resolvable in every liquor, melting and commiscible therewith, brittle as glass, in powder of the colour of saffron but in the entire mass like a blushing Ruby. Khunradus in *y^e Golden Calf*³⁷ p. 32.

The tincture showed to Helvetius was ponderous, glass-like of *y^e* colour of pale sulphur, to *w^{ch} y^e* interior scales of *y^e* crucible still adhered. ib.³⁸ p. 49, 107. The master of the Artist, in a glass-full of Rain water dissolved a very small quantity of a most white powder, and then putting into it an ounce of Cupellate silver laminate, the silver was dissolved in a quarter of an hour like ice in hot water, and one half of it being drunk, tasted as sweet milk and made *y^e* party become very cheerful.³⁹

The charge of *y^e* work is not great nor *y^e* time long, and as to *y^e* matter, there are only two metals and minerals of *w^{ch}* tis prepared. And because the sulphur of Philosophers is more abundant in these minerals, therefore tis prepared of them. And the menstruum is a celestial salt, or salt of a celestial virtue, by the benefit of *w^{ch}* Philosophers only dissolve the Terrene metallick body, and in dissolving the Elixir is produced. And *y^e* operation is performed in a crucible from *y^e* beginning to *y^e* end in an open fire. And *y^e* whole work may be begun and ended in no longer than four days. And the whole work requires no greater cost than the value of 3 florins. Neither is the mineral from which, nor the salt by *w^{ch}* of any great price. But no man can find *y^e* work in his whole life without a Master. *Golden Calf*⁴⁰ p. 66, 67.

Sandivogius in his book called *Cosmopolita*, and Basilius in his 12 Keys are *y^e* most curious authors.⁴¹ Searchers are to know how by some saline suitable ferment grateful to *y^e* metallick nature they may subdue, dissolve, separate, and concentrate not only *ye* magnetical tinging vertue from metals, how to multiply *y^e* same in its own Golden or Silvery nature. *Golden Calf*⁴² p. 119, 120. The Chalybs of Sandivogius is that true Mercurial Metallick humidity by the help of *w^{ch}* without any corrosive the Artist might in an open fire and crucible separate the fixed rays of Sol or Luna from their own body and make them volatile and mercurial for *y^e* Dry Philosophick tincture. *Golden Calf*⁴³ p. 124.

³⁷ This is somewhat condensed from *op. cit.*, n. 36, p. 34 (not 32 as Newton indicates).

³⁸ Transcribed from *op. cit.*, n. 36, pp. 49, 107.

³⁹ *Ibid.*, pp. 55, 56, condensed.

⁴⁰ *Ibid.*, pp. 66, 67, transcribed with minor modifications.

⁴¹ Newton's comment.

⁴² *Ibid.*, pp. 119, 120.

⁴³ *Ibid.*, pp. 123, 124.

Ubi habentur novem partes aquae et una Terrae, Terra putrescit diebus 150 ac dealbatur cum tertia parte aquae id est cum tribus partibus ex novem, et reservantur sex partes divisae in sex filias quibus opus album imbibitur et ad rubedinem deducitur. Senior de *Chemia*⁴⁴ pag. 24, 25, 101 Edit. Francofurti.

Accepimus a priscis Philosophis qui sola natura sunt operati aquam suam vivam in partes duas esse partitam. Qui cum ad albedinem fixam cum altera parte aquae pervenissent eandem cum altera parte reservata, aut etiam solo forte igne rubefecerint. Alii in lapide rubro quia ad supremum gradum ascenderint & per se augeri non possit, labores quas antea confecerint rursum sunt auspicati. Solventes eam rubedinem cum altera parte aquae reservatae, ipsam ad primam, ut ita dixerim, essentiam denuo reduxerunt, laboraruntque pene in omnibus sicut a primordio sed majori quidem tum ignis tum laboris industrias et hanc repetitionem veriorem aut majorem augmentationem crediderunt. *Anonymous de Arte Chem. in Artis Aurif.*⁴⁵ Vol. 1 p. 396.

Ripley in his *Bosome Book*⁴⁶ (printed 1684 by M. Cooper in *Collectanea Chymica*) teaches to imbibe ye white fixt salt wth ye ardent spirit seven times rectified, pouring on so much at once as will just cover ye salt and digesting 8 days till the spirit be dried up, and imbibing & digesting again 8 days till the spirit be dried up, & imbibing & digesting again from 8 days to 8 days till the calx or salt will drink no more but stand liquid, & then to seal up ye glass hermetically & putrefy, digest 150 days in B.M. to ye white, & then to divide the matter & digest one half thereof in a bigger heat (which he calls cinerition) to the red. Then to ferment, he takes refined silver for ye white, and gold purified with 10 times as much ♂ & dissolves each in its weight of oe Lunary or ♀, whereby ye silver gives a green liquor & ye gold a citrine one. Then he rectifies ye ♀ twice or thrice from it & seals up ye oyles of ye ☽ or ☿ severally, and putrefies

⁴⁴ This paragraph is derived from, but does not follow verbatim, pp. 24, 25, 101, of *Philosophiae Chymicae IV. Vetustissima Scripta. I. Senioris Zadith F. Hamuelis Tabula Chymica. II. Innominati Philosophi Expositio Tabulae Chymicae. III. Hermetis Trismegisti Liber de Compositione. IV. Anonymi Veteris Philosophi Consilium conjugii, seu de Massa Solis et Lunae Libri tres. Omnia ex Arabico Sermone Latina facta.* . . . Francofurti, 1605. The book is not recorded as in Newton's library.

⁴⁵ This passage is found in *Artis Auriferae quam Chemiam vocant*. Basileae, 1613. Vol. 1, pp. 617-8, in the treatise *Liber de Arte Chimica Incerti Authoris Cap. XVI.* Newton possessed the edition of 1610 (Ferguson, *Bibliotheca Chymica*. Vol. 1, p. 51). I have not been able to see this, but Newton's page reference appears to be correct.

⁴⁶ This is a very brief summary of passages on pp. 111, 114, 115, etc. of *The Bosome—Book of Sir George Ripley, Canon of Bridlington*, printed (p. 101 ff) in *Collectanea Chymica: A Collection of Ten several Treatises in Chymistry concerning the Liquor Alkahest, the Mercury of Philosophers, and other Curiosities worthy the Perusal*. Written by Eir. Philaletha, *Anonymous*, Joh. Bapt. Van-Helmont . . . London, William Cooper. 1684. This book was in Newton's library.

& digests them [wth the Quintessence. Ripl. Gat. ¶⁴⁷ Stanz. 5, 17] in B.M. till they become crystalline and y^e ☉ first white and then in a greater heat citrine red. These white and red sulphurs are his ferments, one part of w^{ch} is to be added to three parts of y^e white & red Elixirs ‡ (so y^t y^e ferment be $\frac{1}{4}$ th of y^e compound) and this compound decocted again in two or three days passes through all y^e regimens, & becomes the white & red tinctures for metals. Then he incerates, that is imbibes y^e white stone wth y^e white oyle of y^e stone & ye red wth the red oyle, by pouring y^e oyles drop after drop on y^e stones untill y^e stones be oylish, & then decocts & congeals it, & iterates this inceration & decoction till ye stone flow in y^e fire like wax upon a red hot plate of copper wth fuming, & then congeales it up untill y^e white be hard white & transparent clear as crystall, & the red be clear transparant hard, red in colour like a Rubi or Jacynth ; & then they are the medicines of the third order, transmuting all metals into ☉ and ☽ .

These stones he keeps in glasses or boxes in a warm or at least a dry place, because they are oyly and apt to dissolve in every moist place. Ripl.⁴⁸ pag. 112, 113, 114, 115, 116. These stones he multiplies by solution & congelation & digestion, first in B.M. to the white work, and then upon warm ashes, thus iterating y^e work of solution and congelation till the stone within the glass dissolved, will be congealed as soon as he cometh out of y^e pot or B.M. & feeleth y^e cold air without any other manner of congelation to be used, and in every iteration its vertue is increased tenfold. pag. 117. The same way of fermentation is described by Ripley⁴⁹ in his 9th Gate & in the Great Rosary⁵⁰ in these words :

Fili, extrahe a radio suam umbram. Accipe ergo quartam partem sui hoc est unam partem de fermento & tres partes de corpore imperfecto. Dissolve fermentum in aequale sui aquae mercurii. Coque insimul lentissimo igne & coagula illud fermentum ut fiat sicut corpus imperfectum, et orificio vasis claus eodem modo et ordin ut dictum est praeparatum. Rosar.⁵¹ p. 207.

N.B.—To feed y^e newborn child with *milk* & *meat* till he be grown strong, contains all y^e operations of imbibing, fermenting, and incering till he be of y^e 3d order, (Ripley⁵² port. 7, pag. 169, Stanz. 1) the milk being y^e white and red oyles called lac virginis, and the meat being being y^e fixt salt & ferment ffor ffermentation is included in cibation. Ripl. part. II, Stanz. 4⁵³ Philal,

¶ number not legible to me. ‡ no end to this paragraph : bracket added where it seems probable.

^{47, 48, 49} These references to Ripley are hard to verify since the text is not quoted, but it is evident from the pagination and stanza numbers, that they refer to the version of *The Compound of Alchymie in Ashmole's Theatrum Chemicum Britannicum*, 1652, which was in Newton's library : and not to R. Rabbad's edition of that poem.

⁵⁰ Newton means the Rosarium Philosophorum ; *vide* note 51.

⁵¹ The passage is copied from *Rosarium Philosophorum* in Vol. II, p. 207 of the 1613 edition of *Artis Auriferae* (*op. cit.*, n. 45).

⁵² Corresponds to Ashmole's edition (*op. cit.*, n. 49).

⁵³ Corresponds to stanza 4. Gate II. Ashmole's edition (*op. cit.*, n. 49), p. 182.

in Secret. Rev. chap. 32⁵⁴. But most properly the meat is y^e fixt salt w^{ch} they add after inceration or imbibition with the spirit. Marrow of Alk. part 2. lib 3. Stanz 84, 85⁵⁵.

When the work is the first time brought to the white or red, it is multiplied by *sublimation*. And this sublimation consists first in throwing much of the spirit upon little of the body that all may become spirit or ♀, and then by throwing a little of this spirit or ♀ upon much of the body (as I upon 3 or 4) that all by digestion may turn to powder. Ffor accordingly as the sum of the volatile exceeds or is exceeded by the sum of the fixt, all will become volatile or fixt. And thus must the medicine be often lifted up and cast down again, and thereby made often flowing and again made fixed; w^{ch} is the true sublimation of the Philosophers. And their *Exaltation* or flying up by way of multiplication, is nothing else then the reiterating of solution and congelation. Edw. Generosus⁵⁶ p. 4, 5. Isaac Hollandus Op. Min,⁵⁷ I.1.c.38. p. 53, 54.

Edwardus Generosus speaks of 4 stones, the Mineral, Vegetable, Animal & Angelical or the Prospective Stone or divine and magical stone of Moses. The mineral stone is for transmuting metals and hath in him these four natures, that is, he is Animal, Vegetable, Mineral, and Metalline, & yet hath no part of the other three stones in him, nor have they any part of his degrees, because they have not any metalline nature or earthly substance in them. This stone is greatly amended by mixture with any of the other three, & they are thereby debased. The vegetable stone is of a growing nature, and works miraculous

⁵⁴ This passage follows *Secrets Reveal'd, or an Open Entrance to the Shut-Palace of the King . . .* by Eryaeneus Philaletha Cosmopolita . . . London, 1669. Chap. 32, p. 112, Although this is not in the list of Newton's books it was owned by him and still exists. (cf. Duveen, *Bibliotheca Alchemica et Chemica*, p. 470.)

⁵⁵ The stanzas referred to are evidently 84 and 85 on p. 60 of *The Marrow of Alchemy, Being an Experimental Treatise, Discovering The Secret and most hidden Mystery of the Philosophers Elixer . . .* by Eirenaeus Philoponos Philalethes, London, 1654. This work was in Newton's library.

⁵⁶ As far as I am aware, there is no record of the treatise of Edwardus Generosus having been printed. Several manuscript copies exist, including one in Newton's hand (King's College MS. 22). The title runs: 'The Epitome of the Treatise of Health, written by Edwardus Generosus Anglicus innominato who lived Anno Domini 1562.'

Inc. Our medicine ought to be chosen out of those bodies in the wch ♀ is calcine becaus St. Benet saith . . .

Expl. To help her husband to his seat

In March herself to please.

Edwardus Generosus innominatus An^o Domj 1562. 10 die Decembris.

There is a version in the Bodleian Library (Ashmole 1419), said to have been compared with an original in the author's handwriting, and also extracts in a MS in the possession of the Science Library. This entertaining work, which makes large demands on the credulity even of the most enthusiastic alchemist, should be published.

⁵⁷ This passage corresponds to the general sense of Cap. 38., pp. 52, 53, of Hollandus (Johann Isaac): *Opera Mineralia, et Vegetabilia, sive de Lapide Philosophico, quae reperire potuimus omnia . . .* Arnhemii, apud Joannem Jansonium, 1616. Newton owned the edition of 1600.

effects in vegetables and growing things, as in the nature of man or beast. The Animal is for the animal faculties, the Angelical for magical operations. It keeps mans body from corruption, and endues him with divine gifts & knowledge of things, by dreams and revelations. By carrying it about wth him he feels most heavenly fragrant, beravishing smells. And oftentimes (they say) shall see ye apparition of most glorious and blessed Angels. No evil spirit shall endure to come near the bearer thereof, no ye fire burn him. Dunstan calls it Angel's food, because a man may live a long time without any food by the tast of this stone. It is an enemy to all corruptibility in mans body. Of some tis called ye tree of life. The tree of knowledge. Next under God tis dator annorum. The other two are not to be compared to this. The learned stand in doubt whether a man can dye, or not, that hath this stone, saving y^t Mors omnibus communis est. Some think that by it ye Patriachs (*sic*) lived long, and Moses ye servant of God & Hermes otherwise called Henoch did wonderful things. You may by this prospective stone see whats done in any ye world & thereby know whether your wife or friend be true to you, who loves you, hates you, and what shall happen to you before it come to pass. Tis ye most fixt resplendent transparent stone in ye world, as fixt as ☽ and cast upon him alters him into all manner of resplendent transparent colours. The stones of the Sun & Moon shine bright in the dark so y^t you may read wth them. The one is of a hot, the other of a chilling cold nature. The fathers record y^t Hermes (otherwise called Henoch) & Moses & Solomon excelled in the knowledge of this stone & did wonders by it. In the Table of Hermes, called his marble heart, you may see the figure of the two magical stones (or stones of ye sun & moon) & partly how to use them, & read these words
“ I, Hermes, a flying Bird within my mind that with her claws incloses my
“ marble heart, & when she soars up in the wind grasps my stonish heart so
“ hard that where I stand with my right foot on the Sun & left foot on the
“ Moon, she lift up my body and places it so high in heaven that at last [viz. by
“ multiplication] my heart so shines “ as to make dim and dark ye burning
“ light of sun & moon.” In these words are conteined ye foundation of ye
stone in general, both animal vegetable & mineral, ffor he treads upon the
two magical stones wth his feet, whilst the divine, or Angelical, lifted up his
body from them & placed him in heaven. Now if the two afforesaid stones of
ye Sun & Moon are called magical for their operation or wonderfulness in all
degrees of working, Surely by the help of another thing you may do what you
will, even such things as are not to be set down in books. Thus far E. Generosus.

Generosus saith there are 4 degrees of heat each of w^{ch} are double to ye other. 1. A lent heat. 2. A mean or temperate heat as ☽ in July. 3. As strong as fire of calcination. 4. A heat of fusion. That in ye conjunction that follows calcination & solution ye man must have one part & ye woman three. That in this decoction the heat must be increased from 10 days to ten days and be ye 1st degree in ye beginning, & after it has stood 4 months & 20 days in

putrefaction, come by steps to ye 2d degree, and after whiteness, be increased again gradually till it come to ye 3d degree of heat for rubefying, pag. 1, 2. He saith also that in the work of solution (w^{ch} must be made of himself in himself and with himself without violent fire) at every time of his levigation or moisture, the vessell must not be opened till the third hour at least after tis cooled. ib. pag. 1. This solution, he saith, is into water as black as ink. ib. p. 1. Whence (by comparing him with Ripley, Philaletha & Scala) it appears that Ripley omits all the first gross preparation & begins his gates wth the decoction of ☽ and ☿ in ♀ first to a black calx & then to a black water wth are ye two first gates. And then follows separation of elements w^{ch} are one part of earth with 9 of water, & conjunction of one part of earth with three of water and putrefaction of 5 months & congelation & imbibition with the rest of ye water, & Cibation till ye stone be of ye 3rd order. And this is ye work wth ☽ vulgar.

Debet aqua dividiri per medium, medianique ejus partem imbibere per septem hebdomadas super tepidum ignem, et ad gradum majorem perveniet, dein imbibet ei alicum residuum portem in sex hebdomadis, et tunc substantia et color ejus resplendebunt: consil Conjugii.⁵⁸ pag. 240. Edit. Argentorat. 1566.

John Sautre⁵⁹ pag. 25 teaches to cleanse his ♀ by grinding it wth dry salt & a little Vinegre till ye ♀ disappear & ye salt look black, & then washing off ye salt & blackness wth water.

Salem fixum imbibet quarta sui parte de aqua donec pondus suum imbibatur, sublima, rejice faeces, imbibet sublimatum cum suo aere paulatim deinde cum suo igne eodem modo et sic habebis Elixirium admirabile quod super humores malos corporis humani idem fere praestabit quod Elixirium metallorum perfectorum super imperfecta metalla. Elucid.⁶⁰ p. 285, 286.

Vbi terram cum 1/10, 1/9, 1/8, 1/7, 1/6, 1/5, 1/4, 1/4, etc. parte sui de spiritu animale imbibitis donec duplo ponderosior sit aut laminae ardenti imposita in fumum abeat, impone illam in vas conveniens cum longo collo &

⁵⁸ This paragraph is copied from p. 240 of the *Liber Consilii Coniugii de massa Solis et Lunae cum suis compendiis*, contained in *Ars Chemica, quod sit licita recte exercentibus, probationes doctissimorum Iurisconsultorum. Septem Tractatus seu Capitula Hermetis Trismegisti, aurei . . . Argentorati excudebat Samuel Emmel. Anno MDLXVI.* This book was in Newton's Library.

⁵⁹ This passage is a brief summary of the directions on p. 25 of *The Booke of John Sawtre a Monke, concerning the Philosopher's Stone*, printed in *Five Treatises of the Philosopher's Stone. Two of Alphonso King of Portugall . . . One of John Sawtre a Monke . . . Another written by Florianus Raudorff a German Philosopher . . . Also a treatise of the names of the Philosophers Stone, by William Gratacolle, translated into English. To which is added the Smaragdine Table. By the Paines and Care of H.P.* London, Thomas Harper . . . 1652 (corrected to 1651 in handwriting in the B.M. copy.) This work is not recorded among Newton's books.

⁶⁰ The treatise referred to as *Elucid*, is presumably the work recorded in the list of Newton's books as *Elucidatio Metallorum et Metallicorum*. 8vo. 1665. I have not been able to see this work, or discover any mention of it elsewhere.

alembico superposito, atque recipiente (ut paucam humiditatem recipiat) applicato, colloca vas tuum super cineres calidos per 40 vel 50 horas, et terra tua fiet gloriosa et in perlarum aut sabuli forma ad vasis latera ascendet, et mercurium excellentissimum habebis ex quo‡ . . . cum oleo suo conjungatur, magnum Elixir pro medela morborum sequenti modo praeparabis. Accipe unciam unam hujus ♀ⁱⁱ et cum octava olei sui rectificati parte, imbibe et per octiduum coque. Dein eodem modo cum septima, sexta, quinta, quarta parte imbibendo et coquendo, procede, et cum quarta olei parte continua donec materia respuat imbibitionem & in liquidi butyri aut syrupi forma existat: quam rubicundum et virtutis admirandae lapidem corporis humani morbis gravibus medentem quadraginta dies philosophico more coque. Cujus dosis est granum unum atque alterum in vehiculo morborum diversitati conveniente, exhibendum. Elucid. p. 287, 288. Item Rosar. abbrev.⁶¹ Tract 3. pag. 667.

When your Elements of the Gum of Sericon are separated & rectified, imbibe y^e salt wth so much ardent water as will just cover it, & digest it 8 days till y^e water be dried up, & repeat this imbibition & digestion from 8 days to 8 days till y^e salt will drink no more, but stand liquid. Then seal up y^e glass hermetically & putrefy it in B.M. in a temperate heat. And let it continue unremoved in that temperate heat 150 days, till y^e stone in y^e glass become first russett, and after whitish green, & then very white like the eye of fishes: w^{ch} then is sulphur of nature flowing & not evaporating in the fire & o^e white stone to be fermented. One half of w^{ch} you may take out, & digest the other half in a bigger heat to redness. Ripl. Bosome Book ⁶² pag. 112, 113.

Seminate aurum vestrum in terram albam foliatam, id est aurum animae. Et ponite aurum in auro id est aquam in cinere.

Si artis sis peritus dividendi quatuor elementa, facile eadem purificare valeas supra pag Sic Rex Duenech atra bile tumens in balneum laconicum i.e. vaporosum et sudorificum a medico Pharut introducitur ut ibi sudet et tertiae concoctionis faecis per poros excernat, ac deinde exuto colore livido et melancholico vestes regias induat. In hoc totius rei cardo generatur. Maier Embl. 38. Rex ab aquis potatis morbum [i.e. nigredinem] a medicis purgatus sudoribus et curatus sanitatem obtinet et fit elixir. Maier. Embl. 48.⁶³

Jungite siccac humido id est terram cum aqua sua, et coquite donec dealbatur. Et hoc est quod dicit Philosophus, Ipsum dealbate et cito igne sublimate quousque ex eo exeat spiritus qui dicitur Avis aut Cinis Hermetis. Et hic est

‡ Minute illegible letter or symbol.

⁶¹ The treatise referred to is *Tractatus Quintus qui dicitur Rosarium Philosophorum ex compilatione omnium Philosophorum Librorum per Toletanum Philosophum Maximum*. Printed on pp. 663 ff of vol. 3 of the *Theatrum Chemicum*. Argentorati. Zetzner. 1609.

⁶² Modified from pp. 112, 113, of The Bosome Booke of Sir George Ripley. (*op. cit.* n. 46.)

⁶³ *Op. cit.* n. 35, p. 201. The reference a few lines earlier to Embl. 38, is incorrect and should be to Embl. 28.

finis primae compositionis ut Morienus dicit. Nunc ad secundam compositionem transeamus, qua inspiratur tingitur et vivificatur compositio prima. Unde dicit Calindus Philosophus : Nemo unquam potuit vel postea poterit tingere terram foliatam. In istam autem terram aurum seminamus cum tincturam auri [seu vulgaris seu nostri] illi imponimus. Hoc aurum est fermentum totum massam convertens ad sui naturam estque anima conjungens spiritum cum corpore. Nam corpus immundum sine fermento quod est ejus anima, mortuum est et immobile. Accipe igitur quartam partem sui, hoc est unam partem de fermento [seu auro seu sulphure auri :] dissolve fermentum in aequale sui aquae mercurii [forte in spiritu ♀ⁱⁱ ut praecipit Snyderus] Coque insimul lentissimo igne et coagula illud fermentum ut fiat sicut corpus imperfectum [seu rubrum seu foliatum] et orificio vasis clauso eodem modo et ordine praeparatum. Et hoc praecipit Hermes dicens. In principio operis aequales partes permisionis commisce insimul et tere donec desponsetur et ale ut in eis fiat conceptio in fundo vasis. Quinetiam quartam partem fermenti conjunge cum tribus partibus terrae dealbatae et aquam suam imbibe huic et ut prius toties coque haec et reitera donec duo corpora unam fiant sine coloris diversitate. Unde Morienus. Si corpus album fuerit calcinatum, Mille in eam quartam partem sui de fermento auri. Fermentum autem quod corpori intruditur est ejus anima. Unde Morienus : Nisi corpus immundum mundaveris et id dealbatum reddideris et in id animam miseris, nihil in hoc Magisterio direxisti. Ideo fit mistio fermenti cum corpore mutato et non cum corpore immundo. Non enim recipiunt se invicem nisi utrique fuerunt prius mundati. Non enim recipit corpus spiritum neque spiritus corpus ita quod spirituale fiat corporeum vel corporeum spirituale nisi prius fuerit ub omne sorde depurati perfectissime. Quando vero mundantur mox complectentur se invicem corpus et spiritus [id est corpus et anima spiritualis] et pervenit ex eis operatio perfecta. Unde Astanus in Turba Spiritus non conjunguntur corporibus donec ab immunditiis perfecte fuerunt denudati et in hora conjunctionis maxima apparent miracula. Tunc corpus imperfectum coloratione firma coloratur mediante fermento quod fermentum est anima corporis imperfecti : et spiritus mediante anima cum corpore conjugitur, et cum ea simul in colorem fermenti convertitur et fit unum cum eis. Hoc est igitur Elixir (ut dicit Avicenna) quod tingitur tinctura sua et submergitur oleo suo et figitur calce sua. Melius autem et abundantius et sublimius est opus ut album compleatur tribus elementis in quibus non est ignis et citrinum elementis quatuor. Efferar. Monach⁶⁴ in Th. Ch. Vol. 3. p. 155, 156. Et nota, diversitas colorum non appareat nisi in conjunctione animae cum corpore ut dicit Morienus. Dixerunt Philosophi quod lapis ex corpore anima et spiritu est, et verum dicunt : nam corpus imperfectum dixerunt corpus fermentum animam et aquam spiritum. Nam corpus imperfectum per se est corpus grave infirmum et mortuum : Aqua est spiritus corpus purgans subtilians et dealbans.

⁶⁴ The whole passage comes from *Thesaurus Philosophiae* of Efferarius Monachus, printed in *Theatrum Chemicum*, vol. III. Zetzner, 1659, pp. 153–6.

Fermentum est anima quae corpori imperfecto vitam tribuit, quam prius non habebat et in meliorem formam producit. Corpus est Venus et foemina, spiritus est Mercurius et masculus, anima est Sol et Luna ib. p. 157. Aqua nostra est mater diversorum colorum mirabilium quia per illum diversitas colorum apparebit, et hoc erit maxime in missione aquae corporis praeparati et fermentati. Tunc enim infiniti colores apparent quotquot excogitari possunt quia tunc spiritus conjungitur cum corpore et anima. Nam spiritus est locus animae; et anima a corporibus extracta, est aquae tinctura. Unde Senior.⁶⁵ Haec aqua est tinctura soluta in corpore deportata sicut portatur tinctura tinctorum super pannum; deinde recedit aqua per desiccationem et remanet tinctura sua per impressionem: Similiter est de aqua animae in qua portatur tinctura quam reducunt super terram suam albam sitientem foliatam. Recedit aqua spiritualis [ad separationem flegmatis vel forte post putrefactionem] et in corpore remanet anima quae est tinctura (*sic*) solis. Efferar. Mon.⁶⁶ ib. pag. 161 Item. Semita Semitae.⁶⁷ p. 286, 287. Clangor.⁶⁸ p. 327, 328, 329.

Recipe aea nostrum quod cum aquilis novem conjugne et tere ut totaliter spirituale fiat: sine residentia faecum, vasique suo impone, in furnum loca ut eidem immobiliter adhaereat nigredoque putrefactionis apparebit quae diutius dominabitur. Post nigredinem quicumque color appetit laudabilis. Sine intermissione coque usquequo incipiat germinare in viridi colore aimamque (*sic*) evolantem, mediante spiritu, redde corpori suo a quo primo exivit ut conjungatur eidem in albissimo colore conjuncta infrigidetur. Jam habes perfectum lapidem ignem non timentem quem informatum et fixum fermenta utrinque deducendo fixum in volatile et volatile in fixum. Cimbalum aureum in Th. Ch.⁶⁹ v. 3. p. 782.

Sit vas ut nosti cuius tres partes aut minimum duae sint vacuae. Lapidem sufficiat semel vasi imponere firmiter claudendo donec suam biberit humiditatem. Sit pars una corporis et novem spiritus, id est novem aquilae et aeris pars decima in prima scilicet compositione. Ex cimb. aur. in Th. Ch.⁷⁰ v. 3, p. 781. Omnes fere Philosophi asserunt fontem Chymicorum seu mercurium nostrum sine auro et argento perfici non posse. Sed aurum et argentum illud non est vulgare sed in ipsis fontis visceribus enatum estque pars fixa fontis alba et rubea videlicet sol album et rubeum. Quae duo unum et idem sunt quod diverso respectu dicitur aurum et argentum. Sal enim illud cum sextum habeat perfectionis gradum et ad albedinem summam est conductum hinc temporis dicitur argentum. Cum vero idem ipsum sal septimum et ultimum

⁶⁵ The sense of this passage corresponds to that of p. 102 of *op. cit.*, n. 44.

⁶⁶, ⁶⁷, ⁶⁸ The *Semita Semitae* and *Clangor Buccinae* are apparently quoted from *op. cit.*, n. 45.

⁶⁹ Taken almost verbatim from the treatise headed *Extractum ex Cimbalo Aureo, Antiquissimo Libro Manuscripto ad rem nostram faciens*, in *Theatrum Chemicum*. Vol. III, 1609, p. 482.

⁷⁰ Taken *verbatim* from p. 78, *op. cit.*, n. 69.

habet perfectionis gradum, et ultimum coctionis suae terminum alligerit, hunc dicitur aurum. Et sine auro isto et argento foris noster perfici non potest. Haec metalla fonti nostro jungenda sunt cum his metallis coquitur ac digeritur et perenni digestione perficitur et ultimo cum auro vulgi connectitur et permiscetur. Faber. Hydrogr. Spagyri.⁷¹ p. 201, 202.

Succus Lunariae, Aqua vitae, quintessentia, Ardens vinum, mercurius Vegetabilis, omnia idem sunt. Succus Lunariae fit ex vino nostro quod paucis filiis nostris notum est et cum illo fit solutio nostra et fit aurum potabile nostrum mediante illo et sine ille nequaquam. Rosar. Philos.⁷² p. 137.

O natura benedicta et benedicta est tua operata quia de imperfecto facis perfectum cum vera putrefactione quae est nigra et obscura. Postea facis germinare res novas et diversas, cum tua viriditate facis diversos colores apparere. Ista nigredo nuncupatur (*sic*) Terra quae fit levi decoctione totiens iterata donec nigredo superemineat. Et sic habes duo elementa primo aquam per se, dehinc terram ex aqua. Rosar. Philos.⁷³ p. 172.

Rosarius : Quinunque vult intrare Rosarium nostrum et ibi videre et habere rosas tam albas quam rubras absque re vili cum qua nostrae reseratae reserantur, ille assimilatur homini ambulare volenti absque pedibus : quia in illa re vili est clavis ex qua septem portae metallicae aperiuntur et absque illa re vili nunquam pretiosum perficitur. Rosar. Philos.⁷⁴ p. 181. Ista res vilis est lapis in libris Philosophorum nobis ex quo extrahitur aqua philosophica, ib. p. 182.⁷⁵

Ista quidem aqua a corpore mortuo et jam inanimato tollit odorem. Nam et ejus odor est malus et odori sepulchrorum assimilatur. Unde ait sapiens quicunque animam dealbaverit et eam rursus ascendere fecerit et corpus bene custodierit et ab ea omnem obscuritatem abstulerit et odorem malum ab illo abs extra erit, is [animam] ipsam in corpus infundere poterit et in hora conjunctionis maxima miracula apparebunt. Morienus.⁷⁶ p. 24.

⁷¹ This passage is to be found in *Hydrographum Spagyricum, Petri Ioannis Fabri*. Tolosae Tectosagum. 1639, but on pp. 251–252, not 201–2 as Newton says. (Possibly Newton was quoting from Fabre's *Opera Chymica*, 1652 which was in his library).

⁷² This is from *Rosarium Philosophorum in Artis Auriferae. op cit.*, n. 45, p. 137, verbatim.

⁷³ This is from *op. cit.*, n. 72, p. 172, verbatim.

⁷⁴ *Ibid.*, p. 181, verbatim.

⁷⁵ This note is drawn from passages *ibid.* p. 182, but is not a transcription.

⁷⁶ The passage referred to is found verbatim on page 36, not p. 24 as stated by Newton, of the following work :—

De Transfiguratione Metallorum, et Occulta, Summaque Antiquorum philosophorum medicina, Libellus; Morieno Romano, quondam eremita Hierosolomytano, auctore. Accessit huic nunc primum ΧΥΡΩΠΗΜΩΝ: sive de arte Chymica; Dialogus; . . . Hanoviae ad Moenum, apud Gulielmum Antonium, 1593.

I have not been able to find another edition which might account for the discrepancy in pagination. No edition of Morienus is recorded in the list of Newton's library.

Media Lapidis materialia diversi sunt gradus alia enim ex aliis successive eliciuntur. Prima sunt mercurius philosophico sublimatus et perfecta metalla, quae licet extrema sunt in opere naturae, in opere tamen philosophico mediorum loca habentur. Ex prioribus illis secunda educuntur, nempe quatuor elementa, quae vicissim circulantur et *figuntur*. Ex secundis tertia producuntur, sulfur utrumque videlicet cuius multiplicatio primum opus terminat. Quarta et postrema media sunt fermenta sive unguenta exponderata supra dictorum mixtione in opere elixiris successive producta. Ex recto praefatorum omnium regimine creatur tandem elixir perfectum quod supremus est totius operis terminus in quo quiescat tanquam in centro suo Lapis Philosophorum ; cuius multiplicatio nihil aliud est quam praemissarum operationum repetitio. Arcan. Hermet.⁷⁷ Sect. 92. Media operativa sive regimina (quae etiam clavis operis dicuntur) sunt quatuor. Primum est solutio sive Liquefactio, secundum Ablutio, tertium Reductio, quartum fixatio. Per Liquefactionem corpora in antiquam suam materiam refluunt, cocta reincrudantur, fitque coitus maris et foeminae, ex quo generatur *corvus* ; denique separatur Lapis in quatuor elementa confusa, quod contingit per retrogradationem Luminarium. Ablutio docet corvum dealbare et ex Saturno Jovem creare quod fit per corporis in spiritum conversionem. Reductionis munus est lapidi exanimato Animam restituere et rorido ac spirituali (*sic*) lacte eum nutrire quoisque perfectum robur attigerit—Postremo fixationis operatio figit utrumque sulphur super corpus suum fixum etc. Ib.⁷⁸ sect. 93. Media sive signa demonstrativa sunt colores successivi—Primus est niger qui caput corvi diciter. Nigro colori succedit albus, in quo datur primi gradus et sulphuris albi perfectio. Hic Lapis vocatur benedictus : haec est terra alba foliata in qua Philosophi aurum suum seminant. Tertius color est citrinus qui producitur in transitu albi ad rubeum —Quartus color rubeus sive sanguineus etc. Ib.⁷⁹ sect. 64.

PART III.

THE MEANING OF THE SENTENTIAE NOTABILES.

This catena of extracts from numerous authors of different periods, is not simply a haphazard juxtaposition of certain texts that Newton happened to find interesting, but an attempt to do what so many alchemical writers commended, namely to select from the works of many authors the matters they set out clearly, and to combine these so as to give a full account of the process.

⁷⁷ This copies *verbatim* canon LXII (p. 34) of *Arcanum Hermeticae Philosophiae Opus* ; printed in *Bibliotheca Chemica Contracta ex delectu et emendatione Nathani Albinei D.M. . . . Genevae, Sumpt. Ioannis Ant. et Samuelis de Tournes, 1653.* Newton owned this book.

⁷⁸ Consists of the greater part of sect. 63 of *op. cit.*, n. 77.

⁷⁹ Epitomized from sect. 64 of *op. cit.*, n. 77.

Certainly the result does not convey to us laboratory directions by which we can attempt to make the stone, but we find at least a consistency and consecutiveness very rarely found in any alchemical book.

As always, the central problem is to discover and provide the essential material and agent, the philosopher's mercury, and Newton begins by dealing with this. The extracts begin by emphasizing its animal, vegetable, and mineral character, and its power as an agent for dissolution. The distinction is drawn between common mercury and that still in the earth, and potentially capable of being transformed into gold or silver.⁸⁰ The common mercury lacks spirit, and the fiery power of burning. The properties of this mercury are emphasized. It is not only the material, but the agent, the vessel, or the furnace. At this stage, it is emphasized that this mercury must be differentiated into two entities, a *watery spirit* and a *fixed earth*, and that it contains both a *white* and a *red* salt. It contains all that is needed to make the Elixir.

'Our' sulphur, 'our' gold, and 'our' mercury, are all the same. Vulgar gold is dead, and cannot be resurrected unless it be reduced to its primitive and raw state, or to the nature of 'our gold'. Gold, indeed, is three-fold. Astral gold is the pure and fiery salt which the sun produces in his rays, and is carried with the effluvia of the stars through the whole universe. Elementary gold is the salt, pure and fixed, in any body. Metallic gold is the common gold. Any of the three are a possible source of the Elixir or stone, but the first two are to be preferred. Forms of 'our' mercury are the food of the developing stone. The green and vegetable mercury is the food of the basilisk : the red and white spirits are the milk and bread to multiply the animal stone. The merits of 'greenness' are emphasized.

This part of the treatise then makes the point of the necessity and full sufficiency of the philosopher's mercury for the process, and its power of assuming different forms, which later on will be seen as acting one upon another so as to produce the stone.

The next part of the paper deals with the end of the work, the stone itself. The descriptions attributed to Paracelsus, Khunradus, Helvetius, and Elias the Artist, are quoted. The puzzling statement that the whole process can be carried out in a crucible, is brought forward. The process is to separate the magnetical tinging virtue, and multiply it.

Newton then continues with extracts which characterize the process as one in which their 'water' is divided into two parts, one of which is solidified to a salt or fixed body, the other kept as a spirit or liquid. By treating solid with excess of liquid or spirit, all is liquefied : by treatment of liquid with excess of solid, all is solidified. The solidification and liquefaction are operated by a long digestion. The result of alternate liquefactions and solidifications is finally to congeal all the matter. This process is described as inceration, sublimation, conjunction, etc. Several different authors are quoted on this method, which

⁸⁰ Sherwood Taylor, F., *The Alchemists*, p. 199.

Newton regards as the essential process. This process requires a ferment, which is variously interpreted as gold or silver, ' sulphur of gold ', or the white and red fixed salts from the mercury. The remainder of the paper discusses various operative details, and ends with a short of summary of the process.

It cannot be pretended that this series of extracts makes the process intelligible to us, nor is it to be assumed that Newton, were he here to-day, could much enlighten us. The claim that can be made for this work is that it does, at least, present a description of a recognizable process, which, granting the assumptions of the alchemists, can be understood as making sense.

SOME ALCHEMICAL MANUSCRIPTS AT BOLOGNA AND FLORENCE.

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THE purpose of this paper is to give a fuller account of a number of alchemical manuscripts at Bologna and Florence than is offered by existing catalogues, and especially to pay attention to such writings as are little known, being neither available in print nor met with frequently in manuscripts. We begin at the University Library of Bologna, of whose manuscripts the summary catalogue by Frati gives only the briefest description, amounting for each treatise to a mere indication of author and title, with two words of incipit and two of desinit¹. We shall then pass on to consider codices at the Laurentian, National, and Riccardian libraries of Florence. In all we shall treat of some twelve manuscripts. It is hardly necessary to add that there are others where these came from.

* * * * *

Latin manuscript 101 (135 in Frati) of the Bologna University Library is a small octavo of membrane of the fourteenth century or earlier. It opens with the poem of Marbod on gems, which is unidentified in Frati's Catalogue². This is followed by a *Lapidarius* in prose with an unfamiliar opening³. I give the text of its first paragraph on the sapphire and the headings for the other twenty-seven stones treated.

Rubric, " De saphyro lapide et qualitatibus et virtutibus eius ".

Saphyrus. De lapide saphyro qui et syrten appellatur. Invenitur autem in extremis Libie partibus circum Syrtes expulsus a mare per tempestates. Idem nascitur in Apulee regionibus apud Licaonie. Damiceron scribit integer et pontes (potens?) unitit omnes virtutes lapidum que maximas potentias habent et in primo tutamentis numeratus. Qui habet hunc lapidem armatus est contra omnem fraudem et omnibus maleficiis et apud insidias aliorum lapidum resistit. Huius tamen

¹ Lodovic Frati, " Indice dei codici latini conservati nella R. Biblioteca Universitaria di Bologna ", in *Studi italiani di filologia classica*, vols. XVI (1908), pp. 103–432 ; XVII (1909), pp. 1–171.

² The opening verse, " Gemmis a gummis nomen posuere priores ", is the first of four which in another MS. at Tours precede the prologue but more often occur at the end of the poem : see Migne, *Patrologia Latina*, 171, cols. 1757–58, 1770. The last line, which Frati gives as " Effectus miri pro ad abigno comitantur ", is rather " Effectus miri pro ad ab igne comitantur " in our MS., while in Migne 171, 1770 we have " Effectus miri procul ambiguo comitantur ".

³ At fols. 14v–20v (where there are only three lines of text), not 14v–22v, as in Frati, fols. 21–222 being missing.

naturalis potentia dicitur esse divina. Aut (?) si quis a rege vel proposito mittitur in vinculis propter delicta vite, et voluerit eum aliquis educere de vinculo, si fieri potest, tangat capita vinculorum et statim rumpentur, et cum solutus fuerit, veniat ad hostium et tangat hostium cum lapide, et de semet ipso aperietur, et vadat ubicumque voluerit a nullo aspiciente. Est autem circa gratiam et amicitiam conciliandam optimus⁴.

- Fol. 14v, De capnite lapide et qualitatibus et virtutibus eius.
De obtolio lapide et eius virtutibus.
De obsiano lapide et virtutibus eius⁵.
- 15r, De geratite lapide et virtutibus eius.
De iaspide lapide et qualitatibus et virtutibus eius.
- 15v, De lignite lapide et virtutibus et qualitatibus eius.
De topatio lapide et qualitatibus et virtutibus eius.
De magnete lapide et qualitatibus et virtutibus eius.
- 16v, De diadeco etc. (as above).
De smaragdo etc.
De corallo etc.
- 17r, De xebimo etc.
De emattite etc.
- 17v, De lingure etc.
De anphimon lapide.
Calcedonius (the space left before it for the rubric was not filled in).
De salactites (*sic*) quod est smaragdus lapis et eius virtute.
- 18r, De berillo lapide et eius virtute.
De gagatidinio lapide et eius virtute.
- 18v, De etite et qualitatibus et virtutibus eius.
- 19r, De eleutropio lapide etc.
De adamante lapide etc.
- 19v, De menonio (mennoni in the text) lapide etc.
De celidoniis lapidibus et qualitatibus et virtutibus eorum.
- 20r, De celonite lapide et qualitatibus et virtutibus eius.
De cerannionis lapidibus et virtutibus eorum.
- 20v, De iaspide.

On fol. 23r-24v, in addition to the one item catalogued by Frati⁶, may be noted a rubric, “ De calcedonio lapide qui extrahatur de vente pullorum yrundinum ”, although there are only two lines of text under it, prayers for the

⁴ This differs a good deal from Marbod's account of the sapphire: see Migne, 171, 1743-44.

⁵ Of these three stones Marbod treats only “ XLIX. De optallio ”, but the other two are in Pliny's Natural History.

⁶ At fol. 23 only (not 23r-24r, as catalogued): rubric, “ De virtute sigilli sculti in lapide pretioso ”; incipit, “ Si inveneris in iaspide . . . ”. What Frati gives as the desinit, “ . . . postea resolve cum eadem fece ”, belongs rather with an alchemical “ De augmentatione calcinationis solis ”, which begins on fol. 24r.

consecration of precious stones, an alchemical passage ⁷, and on fol. 24v, in a later and smaller hand, a series of brief paragraphs in double columns.

The next two treatises in our manuscript are the familiar Experiments or Secrets or *Liber aggregationis* ascribed to Albertus Magnus ⁸ and the twelve experiments with snakeskin of John or John Paulinus ⁹. The Albertine text considers sixteen herbs and eighteen animals as usual, but only twenty-one instead of about forty-five stones.

Then ensues, at fol. 32v–51v, what Frati describes as a “Collectio quamplurimorum secretorum”, which are chemical, medical and magical. But the incipit that he gives, “Mense Ianuar. sol in aquario. Medio . . .”, applies only to a table which ends with the middle of December. The recipes which follow are too brief and numerous to note except for a few longer items :

Fol. 34v, Ad probandum utrum infirmus evadat an non (8 lines).

36v, Hoc habui ab uno Saraceno. Accipe flores rosmarini . . . (17 lines).

37r, Hec sunt virtutes rosmarini. Recipe flores eius . . . (14 lines).
Recipe flores purissimos et imple fialam . . . (12 lines).
Aqua vite. Huius aque in corpore humano effectus mirabiles sunt . . . (31 lines).

38v, Pulvis mirabilis quem imperator Federicus fieri iussit (17 lines).

39r, Experimentum mirabile quo fac homines in igne sine lesione ingredi . . . (9 lines).

41v, Nota quod ignis volantis per aerem duplex est compositio . . . (9 lines). Other flying fires follow.

47r, Unguentum probatum magistri Luce ad lepram scabiem (12 lines).

47v–48r, Operatio ligni ex mirabilibus magnis (20 lines) ending,
“ . . . Hoc licinium est id quod Hermes faciebat et Ptholomeus et Collectio sapientum cum magister Albertus dicit quod verum sit et ego probavi et ita factum fuit ”.

48r, Ut dormus habeat viridem colorem et avicule circhastantes aparebunt. . . .

Ut herba una hora quiescat et floreat et subito producat . . . ”.
One takes earth raised by the plough and mixes it with blood.

Frati does not catalogue the contents of the manuscript after fol. 51v. Fol. 52v is in a different handwriting ; fol. 53, in yet another hand. From the text at the top of fol. 54r it becomes evident that we are in the midst of

⁷ See the previous footnote.

⁸ At fol. 25r–31r, opening, “ Dicit (instead of, Sicut dicit) philosophus in pluribus locis, omnis scientia est de genere bonorum,” and closing, “ . . . quoniam aliud utilitatis eveniat. Explicit secretum secretorum fratris Alberti Colonensis de ordine predicatorum. Deo gratias ”.

⁹ At fol. 31r–32r, opening, “ Cum ego Iohannes essem in Alexandria . . . ”.

*Kiranides*¹⁰. Most of the remainder of the manuscript to fol. 78 is concerned with animals and is probably from the *De natura rerum* of Thomas of Cantimpré or some similar work.

* * * * *

Manuscript 105 of the library of the University of Bologna (numbered 139 in Frati's Catalogue) is a small double-columned volume of the early fourteenth century with 435 pages written in large letters. In the first column of the second page is a table of contents contemporary with the text, which I reproduce here, adding the pages covered against the items.

Hec sunt nomina librorum philosophorum qui continentur in hoc volumine :

- 3a– 55a *Semita recta*.
- 55b– 66b *Ultimum philosophie secretum*.
- 67a– 83b *Rudianus*.
- 84a–106a *carissime Iohannes*.
- 107b–121a *Albertus*.
- 121b–138b *Magister Arnaldus de Villa Nova*.
- 139a–148b *Aristoteles*.
- 149a–234 *Ebubacre*.
- 235a–280b *Fons aquarum*.
- 267a–272a *liber xii aquarum*.
- 281a–299a *Hermes*.
- 299a–309b *XXX verborum Hermetis*¹¹.
- 313a–338b *Avicenna*¹².
- 341a–388b *Lilium floris*¹³.
- 389a–433a *Turba philosophorum*¹⁴.

Some of these works are well known, such as the *Semita recta* ascribed to Albertus Magnus¹⁵, the Secrets of Nature of Arnald of Villanova¹⁶, the letter

¹⁰ See my *History of Magic and Experimental Science*, II, chapter 46, at pp. 229–35.

¹¹ Frati notes only one work by Hermes, at pp. 281–309.

¹² Frati incorrectly gives the pages as 310–338, but pp. 310a–312b contain “Medicine ad solem”, and briefer recipes for the congelation of Mercury which are not included in the above table of contents.

¹³ Pp. 339–340 are left blank.

¹⁴ Frati makes this entry extend through p. 435, but pp. 433b–435b are occupied by lists of names for the philosophers' stone and of philosophers, which are not noted in the above table of contents.

¹⁵ This and the other treatise ascribed to Albert in our MS. have been treated by Dr. Pearl Kibre, “Alchemical Writings Ascribed to Albertus Magnus”, *Speculum*, XVII (1942), 499–518.

¹⁶ See my *History of Magic and Experimental Science*, III, 73–76, etc.

of Aristotle to Alexander¹⁷, the Thirty Words of Hermes¹⁸, the alchemical treatise ascribed to Avicenna¹⁹, the *Lilium*²⁰ and the *Turba philosophorum*²¹.

Less familiar is *The Final Secret of Philosophy*, which opens, “ Hec est porta lapidis et operationis eius . . . ” and closes, “ . . . in solem preciosum. Explicit opus lapidis philosophorum deo gratias videlicet ultimum philosophie secretum ”. Stating that hitherto philosophers have spoken obscurely concerning their stone, the writer announces his intention of revealing their secrets²². The stone is an egg whose father is a cock and mother a hen. It has three materials and four natures. The three materials are shell, white and yolk. “ It is soul and there are four complete natures in it, and there is no other philosophers' stone but it.” Its parts are quickly separated and easily mixed together. If anything extraneous is mixed with them, the operation fails, since it requires nothing other than itself. No philosopher records the first part of the work but only the second, that the truth may not become apparent to all, but our author will set it forth entire, “ as I have gathered from divers volumes and the utterances of various philosophers ”.

Take this stone when the sun enters Capricorn on the day of its nativity and begin to work when the moon is separated from evil associations and joined to fortunate. Separate its parts, first washing well with salt, and distill the white and keep it and preserve the dregs, because they are of the nature of air. Distill enough of the white to last you through the process, because this water is the root of the whole operation, since with it are conjoined the four natures of the stone, and with it are whitened and washed up all impurities, and it is the beginning and the end. So you ought to have enough of it.

Then extract an oil from the yolk, and it is a third part of it, of hot and dry nature. You obtain a black oil, from which the red tincture is made, and this is what colours red at the end of the process. Keep it for your use.

¹⁷ *Ibid.*, II, 253. However, the text in our MS. differs from those there listed or in Thorndike and Kibre, *A Catalogue of Incipits*, 1937, but is a part of the *Secretum secretorum* of the pseudo-Aristotle: pp. 139a–148b, rubric, “ Incipit epistola Aristotelis missa Alexandro de secreto secretorum ”; incipit, “ Hinc est nostre intencionis, O Alexander, quod de qualitatibus et proprietatibus et virtutibus quarundam herbarum . . . ”. Compare *Secretum secretorum cum glossis et notulis . . . fratris Rogeri*, ed. Robert Steele, Oxford, 1920, p. 114, where *Pars tertia* opens, “ De proprietatibus et qualitatibus et virtutibus quarundam herbarum . . . ”. The ensuing text is at first alchemical.

¹⁸ *Liber triginta verborum* is also ascribed to Aristotle and Geber, or occurs anonymously.

¹⁹ Here opening, “ Tractata sunt inter me et Halhalsen . . . ”. More often the incipit is, “ Pertractata sunt inter me et Hasen . . . ”. See *A Catalogue of Incipits*, cols. 484, 724.

²⁰ Here opening, “ Natura (in most MSS., *Naturam*) circa solem et lunam . . . ”.

²¹ Here opening, “ Cum turba philosophorum plurima de regionibus . . . ”. See J. Ruska, *Turba philosophorum*, 1931, p. 83.

²² P. 55b, “ De hoc namque lapide locuti sunt philosophi obscure verbis suis non intelligentibus nisi sapientibus. Ideo parcat mihi Deus, quoniam intendo eorum occultationes aperire de hoc lapide ”.

Then wash the shells with salt and water until they are well cleaned from skins, rubbing them well in your hands, and dry and put in a glass vessel, not a glazed one, and place in the furnace or in *achenor* and leave it till it turns white like chalk. This chalk is the root of the whole work without which nothing can be accomplished²³.

I have listed manuscripts of the Book of Divinity or of Three Words by Rudianus elsewhere²⁴, but may add here its incipit and desinit more fully than as given by Frati, and a list of its rubrics or headings :

- 67a, Incipit liber Rudiani liber divinitatis et est liber trinitatis, id est, trium verborum, et hec tria verba sunt de lapide precioso qui est lapis omnium lapidum preciosorum et est corpus volatile aereum. Lapis iste est albus albissimus. . . .
- 68b, De opere mirabili.
- 70a, Operacio planetarum (of nine months' duration).
- 72a, Documentum filii regis Persarum.
- 74b, Dat artem procedendi.
- 75b, Ostendit perfectionem operis.
- 76b, Argumentum circa operacionem.
- 77b, Probacio ad lunam.
- 78b, Ad lunam.
- 80b, Ad lunam.
- 81a, Ad lunam.
- 82a, Ad lunam.
- 83b, . . . Ego karissime conservans secreta secretorum philosophorum libellum composui ad tui eruditionem ut philosophorum scientiam valeas imitari. Explicit liber Rudiani et illa sex recepta ad lunam non sunt de hoc libro.

What the table of contents called " carissime Iohannes " is more fully described in the text itself, where, at p. 84a, is the titulus, " Incipit expositor super Racaydibic ", and the incipit, " Hic liber carissime Iohannis est liber Neapolonis et est liber paritatis et liber deitatis patris et filii, id est, duorum verborum. Intelligas me sane quia intelligenti intelligens . . . ", and at p. 105a, " Explicit carissime Iohannes revelans secreta secretorum omnium philosophorum alkemie ". Racaydibic or Racaydyby is a name which I have seen only in manuscripts at Bologna²⁵, but a *Liber paritatis* with the same opening words, " Intelligas me sane quia intelligens me . . . ", occurs in a manuscript at Venice : S. Marco VI, 214 (Valentinelli, XVI, 3), a.1472, fols. 208–211. As for " Liber Neapoleonis ",

²³ Subsequent rubrics of our text are : p. 58b, De secunda via ; 60a, de via aggregativa materiam ; 60b, De tinctura rubee ; 65a, Hec est scala secunde albacionis.

²⁴ *A History of Magic*, etc., III, 44 ; also *Speculum*, XI (1936), 380.

²⁵ In a later MS. Bologna University Library 270 (457), VI, 5, opening, " Hic est liber Racaydyby ". In the still later printed collections of the 16th and 17th centuries it becomes " Rachaidibi " : see *A Catalogue of Incipits*, col. 215. Steinschneider connected it with Khalid b. Jazid, " Die Europäischen Uebersetzungen aus dem Arabischen ", *Vienna Sitzungsberichte*, Philos.-Hist. Klasse, 151 (1906), 28–31. But see p. 109 concerning MS Riccard, 944, at Florence.

it may be noted that John Dastin addressed works of alchemy to a Neapoleo or Neapolitonus who was cardinal of St. Adrian²⁶, and that alchemical recipes are attributed to a cardinal of Naples²⁷.

"Ebubacre" presumably refers to Rasis, but the incipit here, "Cum diversi diversas opiniones et operationes posuerunt . . .", is not that of his *De aluminibus et salibus*, and the text so opening seems to be preserved only in this manuscript.

"Fons aquarum" I also know only through this manuscript. In the text it is entitled "Fons montium, aquarum puteus"²⁸, and opens and closes as follows:

235a, Fons montium, aquarum puteus vocatus est hic liber roridus
Alkamie semita est directa Mercurii nonnumquam (?) distincta
detegit elementa Mercurius evolans dicitur. . . .

280a, Cum multis et diversis preparacionibus de lapide philosophico
in enigmate philosophi tractaverint et cuilibet insipienti et
legenti receptas prima facie trufatorium videatur librosque
et scientiam quamplures vilipendant. Idcirco volens eorum
intellexus consoli- (280b) dare significo quod Avicenna pater
philosophorum necnon quamplures alii philosophi tradiderunt
nomen lapidis et operacionem in receptis, et qui ipsum
lapidem novit mea verba denegare non presumat. Explicit
liber aquarum.

There follows a list of the rubrics in the text:

P. 235b, Aqua Mercurii, Aqua Mercurii.
236b, Aqua vite, Aqua fixans Mercurium.
237a, Aqua congelans, Congelatio Mercurii.
237b, Aqua congelans M. Congelatio Mercurii.
238a, Fixio Mercurii. Congelatio Mercurii cum succo sicutae.
239a, Calxinatio M.
239b, Sublimatio M. Maleatio Mercurii.
240a, Aqua retinens omne corpus. Aqua uzifur ad solem.
241a, De aqua uzifur ad solem.
241b, Aqua que dicitur lac virginis.
242a, Aqua aquile solvens corpora.
242b, Ad denigrandum aqua, Ad removendum, Alia.
243a, Aqua alkaly.
243b, Aqua ferri.
244b, Aqua sulphuris.

²⁶ Dorothea Waley Singer, *Catalogue of Latin and Vernacular Manuscripts in Great Britain and Ireland*, I (1928), pp. 262, 266. Neapoleo Ursinus or Napoleone Orsini was named cardinal deacon of S. Adriano in 1288 and died only in 1342. Perhaps John Dastin concocted an elixir of youth for him.

²⁷ James Corbett, *Catalogue des manuscrits alchimiques latins*, I (1939), pp. 215, 217.

²⁸ Giovanni Carbonelli, *Sulle fonti storiche della Chimica e dell'Alchimia in Italia . . .*, Rome, 1925, p. 130, gave the title correctly but the number of the manuscript as 184, and the pages covered as 235-260.

245a, Aqua puerorum, Preparacio aque dulcis.
 245b, Aqua sancta.
 246b, Aqua gummi arabici, Aqua calxis corticum, Aqua dulcificativa.
 247a, Aqua dans ingressum.
 247b, Aqua tartari, Aqua tingens omnem spiritum.
 248a, Aqua corosiva.
 248b, Aqua fingens sulphur, Aqua solvens argentum.
 249a, Aqua ovorum, Aqua elementorum.
 249b, Aqua fixans lapidem.
 250a, Alia aqua albuminis ovorum.
 250b, Preparatio cum aqua salis.
 251a, Incipit capitellum de aquis tingentibus et rectificantibus
 Mercurium et solem aliaque metalla colorantibus et primo
 de aqua divina. Capitulum de solutione, scribe de v. paradiso
 et dicitur aqua divina.
 252a, Aqua tingens M.
 252b, Aqua rectificationis.
 253a, De aqua pilorum.
 255a, Capitulum de solucione, scribe quod aquisivimus a quibusdam
 parochianis (?) et heremitis.
 256b, Extractio aque capillarum (?), Aqua fingens et rectificans.
 257a, Aqua solvens solem et lunam et vitrum calxinatum.
 258a, Aqua albificans removens sonum Saturni.
 258b, Aqua rubea ex qua extrahitur oleum ovorum.
 259b, Aqua reducens omnia corpora ad primam materiam.
 260b, Ad dandum ingressum cuilibet medicine non habenti.
 261a, Ad faciendum Venus tingens ad ponderosum.
 261b, Aqua solis.
 262a, Ad faciendum aquam lune, Aqua.
 262b, Ad faciendum aquam calxis ovorum, Aqua auree.
 263a, Aqua solis.
 264a, Aqua lune.
 264b, Aqua Mercurii.
 265a, Aqua rubea solvens M. Aqua rubea solvens M.
 265b, Rubificatio lune.
 266a, Rubificatio Mercurii, Coloratio auri.
 266b, Tintura solis.
 267a, Incipit liber 12 aquarum, Libelli huius aquarum series 12
 splendet ²⁹.
 272a, Explicit liber 12 aquarum. Aqua sanguinis humani.
 272bis, a, Aqua albificans, Aqua que dicitur elixir.
 272bis, b, Aqua que dicitur elixir, Aqua tartari.
 273a, Aqua calxis, Aqua mollificans corpora.
 273b, Oleum mirabile.
 274b, Oleum sulphuris preciosum.
 276b, Incipit capitulum dealbacionum et primo de aqua tingente
 mirabiliter quicquid invenit.
 277a, Dealbacio, Dealbacio.
 277b, Dealbacio.
 278a, Dealbacio.

²⁹ On books of twelve waters see *A History of Magic*, etc., II, 251, 500–501, 797–99.

278b, Alia dealbacio.
 279a, Alia dealbacio.
 279b, Dealbacio mirabilis.

The character of these waters may be briefly suggested by comparing two recipes for aqua tartari :

P. 247b, Aqua tartari sic fit, Calxine tartarum in igne forti quousque fuerit cinis albus et tunc tire et suspende in quodam saculo in loco humido et distillabitur aqua que dicitur aqua tartari.
 P. 272(bis)b, Aqua tartari et gri (*p. 273a*) socolla que est gummi et calxis alkali dealbat cutim. Aqua duarum rerum in qua luna soluta sit fixat medicinas. Prebet ingressum et duplicet eius effectum.

The work attributed to Hermes in our manuscript and opening, "Cum in tanta etatis prolixitate experiri non desisterem . . .", is elsewhere entitled "Septem tractatus in operatione solis et lune" ³⁰. It is followed in our manuscript by a "Second Book of Hermes", which is followed by books 3, 4, 5 and 6. There thus seem to be six books instead of seven tractates ³¹. Then follows the Book of Thirty Words of Hermes ³².

Perhaps it is counted as the seventh tractate.

* * * * *

Several alchemical manuscripts in the Bologna University Library have already been treated by me elsewhere : 104 (138 in Frati's Catalogue), 190 (142), 110 (143), and 153 (164) ³³. But one or two tracts which occur only in one of these manuscripts, either have not been previously noticed or merit a fuller description. Frati, followed by *A Catalogue of Incipits*, dates 109 (142) as 15th century, but it contains, in vol I, fol. 155r, an "Opus expertum Parisius et ab ipsomet philosopho comiti Contigiano exhibitum anno domini 1540". In the treatise on the three fires of the philosophers which follows soon after it, the incipit may be extended from "Quia secundum . . .", which

³⁰ It is also sometimes entitled *Phoenix* or perhaps purports to be by the phoenix who lived to five hundred years. See *A History of Magic*, III, 637.

³¹ At pp. 290a-299a : titulus, "Hic incipit secundus liber Hermetis"; incipit, "Fili scito quod philosophi fortibus spiritus vincunt nexibus . . ."; p. 292a, "Incipit tertius liber Hermetis"; p. 294b, "Incipit 4 liber Hermetis"; p. 295b, "Incipit 5 liber Hermetis"; p. 297b, "Incipit 6 liber Hermetis"; p. 299a, "Explicant sex libri Hermetis".

³² With the usual incipit, "Iam tu scis qui hanc queris . . .", of which "Iam scis tu . . .", "Nam tu scis . . .", and "Viam si quis . . ." are mere variants.

³³ See Index of Manuscripts in vols. III and IV of *A History of Magic and Experimental Science*.

does not distinguish it from seven other works, to "Quia secundum philosophos indigemus igne naturali . . .". Among the topics considered in the text are :

- 169f De compositione primae aque mineralis sive Ignis contra naturam.
- 169v De dissolutione lune.
- 170r De compositione secundae aquae sive ignis innaturalis.
- 171r De compositione tertiae aquae sive ignis naturalis.
Exuberatio dictae aquae naturalis.
- 172r Certa notabilia super opera bene notanda.
- 173v Fixatio sulphuris.

The treatise seems to end in mid-page on fol. 174r, not on 174v, as stated by Frati.

In the same manuscript, in connection with fol. 208r, "Sequuntur dicta domini Raverii Angli de lapide philosophorum", we read in the margin, "optimus Tractatus et relegendus. Videtur extractus a libris R.L." (Raymundus Lullius), and the incipit may be extended to "Dicit quod subiectum contrahitur a Cahoa (Chaos) quod fuit prima materia . . .". In the *Dicta* of Renatus which follow those of Raverius at fols. 211r-214(bis)v, a fuller incipit is "Dicit dominus Renatus quod opportet calcinare aurum antequam ponatur in igne lapidis . . .", and a fuller desinit, ". . . est sententia. Finis dictorum Raverii et Renati".

In manuscript 110(143), 16th century, 19 lines to a page, Frati's very brief notice of the first treatise, at fols. 1r-64r, may be enlarged as follows :

- Fol. 1r, Speculum artis naturalis, Liber Saturni. In nomine domini nostri Iesu Christi Amen. Ut ad rerum nos omnium perfectam scientiam pervenire possimus, primo oportet scire quod tres sunt lapides et tres sunt sales. . . .
- Fol. 10r, Capit. 2. De principio huius magisterii.
- Fol. 13v, Cap. 3. De secunda dispositione.
- Fol. 15r, Cap. 4. De tertia dispositione.
- Fol. 15v, Cap. 5. De 4a dispositione.
- Fol. 16r, Cap. 6. De 5a dispositione.
- Fol. 20v, Cap. 7. Incipit dispositio septima (*sic*) que vocatur Liber Saturni in quo totum magisterium nostrum consistit.
- Fol. 59r, ". . . Magister, rogo te ut mihi amplius regimen lapidis ostendere. Fili mi carissime, iubeo te accipere occultum et honorabile arcanum quod est es nostrum. . . ."
- Fol. 59v, The text ends, ". . . per infinita secula seculorum Amen".
- Fol. 60r, "Recapitulatio sub brevitate totius operis".

In the next tract, *Lilium intelligentie philosophorum*, which Frati ascribes to Sarne philosophus, I did not see that name. It opens at fol. 64v, "Ad compositionem uniuscuiusque opusculi dicimus semper invocandum auxilium . . .". A master and disciple converse, but there are no rubrics or chapter headings. At fol. 64v the master says :

Igitur ego minimus et indignus sub Dei timore non presuntuositer cum obedientia maiorum nostrorum magistrorum inclinatus via completa totius operationis universalis ab omnibus occultata meo fideli discipulo ordi (fol. 65r) natim reseraboo.

At fol. 65v, "Explicit Prologus", and the text opens, "In nomine domini nostri Iesu Christi Amen. O fili carissime scias quod in principio spiritus domini ferebatur super aquas . . .". The disciple soon complains that the master first says that the stone is one, and then that it is three, and is told that "Sublimatio nostra non est vulgi", and that what is elevated is not important but what remains at the bottom. Separation of the elements consists merely in sublimation, and there is only one vessel and one furnace. The master talks in terms of body, soul and spirit, and the disciple takes an oath not to reveal the secret of solution.

Modus ergo faciendi solutionem talis est. Postquam lapis noster in igne mundissimus factus est et absque omni sorde, tunc contere ipsum in pulverem valde subtilem super unum lapidem et in aceto nostro clarissimo aliquando (?) (fol. 72v) solve et statim solvetur in aquam philosophicam clarissimam et quasi fontaneam. Et cum lapis noster solutus totaliter fuerit ut dixi, tunc distilla distillatione nostra et coagule in ignis temperamento, id est, calore temperato et ultimo coleina per modum suum ut superius repetii. Et scias fili quod in quarta solutione lapidis una pars tingit 100 partes Mercurii vel alterius metalli in veram lunam vel in verum solem secundum quod preparatus fuerit elixir sive lapis, et hec est solutio nostra et secretum secretorum.

The disciple expresses profuse thanks for over two pages, but in return the master only asks that he love God. The disciple then asks the secret of multiplication and the master answers him "theologically and physically". But our sulphur is not the vulgar sort, and so on. The disciple asks him to speak less in riddles, but he makes it no clearer than before, and the tract ends with the disciple thanking him again.

* * * * *

Collections of waters (*aqua ardens*, *aqua vitae*, *aqua fortis*, *aqua mercurii*, *aqua sanguinis*, etc.), like collections of other recipes, secrets and experiments, were a prominent feature of medieval chemical and medical literature³⁴. They form the leading feature of two manuscripts in the Laurentian Library at Florence, to which we next turn our attention.

Gaddi reliq. 137 of the Laurentian Library at Florence is an attractive little octavo manuscript of forty-one leaves of the early fifteenth century, neatly written on membrane with illuminated initials and well preserved. Bandini described it nearly two centuries ago as "optime servatus"³⁵ and said further :

It begins with the virtues of *aqua vitae* and rosemary and closes with the confection of an unguent against paralysis, stupor, humor

³⁴ See Lynn Thorndike, *A History of Magic and Experimental Science*, II, 251, 500, 797-99, and *Aqua* in the indices of subsequent volumes and of Thorndike and Kibre, *A Catalogue of Incipits of Medieval Scientific Writings in Latin*, 1937.

³⁵ A. M. Bandini, *Catalogus codicum latinorum Bibliothecae Mediceae Laurentianae, Florentiae, 1774-1777*.

and all nervous diseases. It deals in especial with many and varied sorts of waters and the cure therewith of varied diseases of the human body, together with the method to be followed in compounding them.

The work on the virtues of *aqua vitae* with which the manuscript opens is identifiable from its incipit³⁶ as by Taddeo Alderotto of Florence who died in 1303. The virtues of rosemary are said to be twenty-five in number³⁷, but our text stops with the twentieth³⁸. Meanwhile it has informed us that the upper teeth are caused by the brain and the lower teeth by the stomach, so that he who wishes to cure the upper teeth should cure the brain or make a medicine useful to the brain. And he who wants to cure the lower teeth should treat the stomach, and the patient will get well. Returning to the virtues of *aqua vitae*, we learn that in its first distillation it burns but does not burn cloth, and so on³⁹. We are then told how to make an *aqua vitae* which is good, wholesome, very useful, and in common use⁴⁰.

Our text turns for a time to balsams⁴¹, comes back to a water made from turpentine⁴², then shunts to balsams and oils⁴³, terminating with "a balsam with which the queen of Albert, the one-eyed king of the Romans, was embalmed"⁴⁴. Next comes a water to light a dark house, in which fire-flies are an ingredient, and a water lighting up the night⁴⁵. After an oil good for everything ("Oleum valens super omnia") follow waters from human blood and one from human excrement⁴⁶. Balsams again intervene⁴⁷, but then for some time our text is exclusively concerned with waters.

The first two put one to sleep, the third dissolves iron and other metals, the fourth is *aqua fortis*⁴⁸. We come to a water whose distillation at first is of no value, but the second is good and especially when, if a drop of it is let

³⁶ Gaddi reliq. 137, fol. 1r, "Hec sunt virtutes aque vite, primo quod omnes passiones in corpore ex frigidis humoribus precedentes curat . . .". See Thorndike and Kibre, *A Catalogue of Incipits*, 1937, col. 288.

³⁷ *Ibid.*, fol. 3v, "Hec sunt virtutes rosmarini 25 numero . . .".

³⁸ Fol. 4v, adding, "Multa quidem et alia utilia humane nature procurat per gratiam dulcissimi Iesu Christi".

³⁹ See *Magic and Experimental Science*, III, 178.

⁴⁰ Gaddi reliq. 137, fol. 5r.

⁴¹ *Ibid.*, fol. 6r, "Aliud balsamum"; 7r, "Aqua quasi balsamum . . .", "Balsamus ita fortificatur . . ."; "Aliud balsamum"; 7v, "Balsamum melius huius mundi . . ."; "Alius balsamus".

⁴² Fol. 8v.

⁴³ Fol. 9r, "Aliud balsamum bone et utile"; 9v, "Aliud balsamum . . .", "Oleum quod ponitur loco balsami . . .", "Oleum aliud balsami"; 10r, "Oleum laterinum benedictum"; 10v, "Aliter etiam et alio modo . . .", "Oleum benedictum sic etiam fit".

⁴⁴ Fol. 11v. The reference is to Albert I, of the house of Hapsburg.

⁴⁵ Fol. 12r.

⁴⁶ Fols. 12v-13r.

⁴⁷ Fol. 13r, "Balsamus sic fit"; 13v, "Alius balsamus" and "Balsamus bonus".

⁴⁸ Fols. 13v-14v.

fall on a bit of mercury on a glass plate, it begins to boil and to fight with the mercury⁴⁹. We pass on to an *aqua fortis*, marvellous and sharp, which corrodes all metals, to an "Aqua valde Iversiva", a water which deletes letters, and three others⁵⁰. A marvellous water which totally blackens everything cannot be eradicated except by the following water, which is contrary to it. Another blackens human flesh; five more follow. Then, after one which divides silver from gold and another which dyes with a golden colour, is a third which colours horses and dogs green⁵¹. Four hair washes are succeeded by an eye-wash. There is a water to produce golden letters on iron and to gild letters which have been carved or intagliated on iron, and a water of marchasite which works against even confirmed cases of cataract⁵².

In the former case highly polished iron is to be treated with varnish and the letters or other design made on the varnish. "And scrape the varnish well with a knife and have the iron very shiny where you wish to gild." This done, heat the iron slightly and dip a bit of cotton in the water and moisten with it where the letters or intaglio are. The water is made of rock alum, sal ammoniac, alum zucharinus, gum *botte*, roman vitriol, and a little green copper, pounded fine and boiled down one-half. After the letters and figures on the iron have been tinged with the water, ground gold is to be rubbed over them, then dried gradually at the fire so that the gold may not lose its colour. And the gold should be ground with quicksilver⁵³. Another water to write gold letters on iron is briefer and has a single ingredient.

Take bull's horn abraded externally and cut it to bits and distill it in a sealed glass vessel, and when the operation is finished, write with it on iron⁵⁴.

⁴⁹ Fol. 17r.

⁵⁰ Fols. 17v-18v.

⁵¹ Fols. 19r-21r.

⁵² Fols. 21v-23r.

⁵³ Fol. 22v: "Aqua ad faciendum litteras aureas super ferrum et deaurandum litteras sculptas sive intalliatas super ferro. Capias ferrum bene nitidum et pollentem et quanto magis tersum est tanto melius. Postea vernica ipsum ad ignem et quando vernicatum erit, fac pictorem designare super vernice literas vel figuram aliud quod tibi placeat, et rade bene vernicem cum uno cultello, et fac quod ferrum sit bene nitidum ubi vis deaurare. Hoc facto calefac ferrum modico ad ignem et habeas aquam infradictam et balnea in ipsa modicum bombacis et madefac ubi sunt litere vel intallia cum dicto bombace, et veniet rubeum tamquam ramum. Aqua sic fit. Recipe alluminis rozie uncia 1, salis armoniaci dragma 1, alluminis zucharini dragme ii, gummi botte dragma 1, vitrioli romani dragma 1, et modicum viridis eris. Res istas pista subtiliter et fac bullire in uno vase ~~renu~~ tanto quod redundet ad medietatem. Et cum dicta aqua tinge litteras et figuram signatas super ferro. Postea tolle aurum macinatum et frica cum uno tocatolio rotundo de ramo et iniuna ferrum et postea sicca ad focum temperate ut aurum suum non mittet colorem. Debet esse aurum macinatum cum argento vivo et postea confricatum super figuris sicut dictum est. Habebis pulcrum opus secundum quod signaveris.

⁵⁴ Fol. 27v.

Between these two processes there have been various waters to whiten ladies' faces and to remove warts, also a mysterious "Aqua dans pondus stellis gleucis", and another which softens all metals. We proceed to a water of mercury excellent for beautifying ladies' faces and for many other things, to a marvellous water for clarifying the eyesight, and to a marvellous water, said to be of metals, by which a physician will work such wonders that he will not be called a doctor but a prophet.

Take filings of silver, copper, iron, lead, steel, gold, of gold or silver plate, or storax according to the wealth and poverty of the patient. On the first day let all be put in the hot urine of a virgin boy with his night; on the second day, in hot white wine; on the third day, in fennel juice; on the fourth day in whites of eggs; on the fifth day, in milk of a woman who is nursing a boy; on the sixth day, in red wine; on the seventh day, in its own sevenfold or in seven pounds of whites of eggs. Put it all in a bell and distill over a slow fire. And what is distilled preserve in a vessel of gold or glass or silver.

Maintain silence as to praise of this water, for it cannot be bought. Its virtue skins lepers, removes leprosy which is not genuine, blots out every spot, preserves youth, destroys eye-spots and makes the eye beautiful above all. Henceforth I keep silent as to the secrets of this water, for fear lest its possessors wax too proud⁵⁵.

After two depillatories comes a water for weeping eyes and a golden water for writing⁵⁶. But then follow instructions concerning a ring, the wearing of which will prevent one from falling in an epileptic fit. In making the ring, one must observe the moon, sign of the zodiac, even numbers, the day of the week, and sunrise. It is to be of pure gold or silver and have written on it the magic names: +angelias+gutoam+guth+. A water now comes into the procedure with the instruction to wash the ring thrice in rose water, each time changing the water and saying a Paternoster and at the end of each Paternoster adding, "I wash you in this water in the name of the Father and of the Son and of the Holy Spirit, Amen, that you may obtain the virtue that whoever has you on his or her person or fingers of the hand shall never be able to fall in an epileptic fit". This done, nine masses are to be said over the ring by a good priest and at the end of each mass he is to bless the ring. The masses are enumerated as three of the Holy Spirit, one of the Trinity, one of Epiphany, two of St. Mary, one of the Assumption and one of the Annunciation, one of the Nativity and one of the Resurrection, which would seem to make eleven in all rather than nine⁵⁷.

Another water gives spirits ingress to bodies and expels spirits which are not fixed. "And used in the place of balsam, it has all its virtues and more."⁵⁸

⁵⁵ Fol. 31r.

⁵⁶ Fols. 32v-33r.

⁵⁷ Fol. 33v.

⁵⁸ Fol. 34r.

Several pages are then devoted to powders, including another recipe against epilepsy⁵⁹ and a wax made of cow or bull fat or butter⁶⁰. For a short spell our text falls into the Italian vernacular⁶¹, but returns to Latin with a Water which is called the Mother of Balsam⁶². It terminates with a syrup, a bath, and two unguents⁶³.

* * * * *

Gaddi reliq. 175 is an octavo paper manuscript of the fifteenth century, written in different hands, one of which gives the date, August 18, 1463⁶⁴, and covering 48 leaves. It opens with an *Aqua* in Italian⁶⁵; lists thirty virtues of an "Aqua mirabilis et fortis secundum notata Aristotelis"⁶⁶; has a water which is like balsam⁶⁷, and other oils and waters⁶⁸.

This manuscript also includes more distinctly alchemical tracts: a *Descensorium*, "made by me, Basilius, in 1461 at Ferrara in the house of the distinguished doctor, Agostino of Rimini"⁶⁹; a *Practica* of Philip for making silver⁷⁰; and an alchemical recipe by the same Basilius, which he says had been tested by his own hands and by the Reverend Raynaldus of Este. It took him a month's work and he advises to take plenty of time in putting it into operation⁷¹.

The content of the manuscript is also partly medical, such as a plaster attributed to Geoffrey of Meaux⁷², a remedy for the pest⁷³, and Adidem

⁵⁹ Fol. 37r.

⁶⁰ Fol. 36v.

⁶¹ Fol. 38r.

⁶² Fol. 39v.

⁶³ Fols. 40r-41v.

⁶⁴ At fol. 10r, top margin.

⁶⁵ Fols. 1r-2r, incipit, " Recipe garofali nucis muscate zinziberis . . ." and other spices.

⁶⁶ Fols. 4v-6v, incipit, " Recipe vitrolo romano 11. 1, sal nitri 11. meza . . .".

⁶⁷ Fol. 24r, incipit, " Recipe nucis muscate garofoliorum gardamom grana paradisi . . .".

⁶⁸ At fol. 26 *et seq.* At fol. 25r, the incipit, " Libri huius duodecim splendet capitulis . . ." resembles " Libelli huius series aquarum duodecim . . ." for which see *A Catalogue of Incipits*, col. 385.

⁶⁹ Fol. 9v, " Descensorium factur ver me Basilium MCCCCLXI Ferrariae in domo eximii doctoris D. Augustini de Arimaniu".

⁷⁰ Fol. 10v, " Practica Philippi ad album ", opening, " Recipe stagno parte una M' purificato . . .".

⁷¹ Fol. 16v, " Expertum per Ill. ac Rev. d. Raynaldum Estensem me presente et per proprias manus mei Basili nec minime verum invenitur nisi laborem quem ego ipse pertuli per mensem. Consulo ergo ne tempus omittas in operando ".

⁷² Fols. 2v-3v, " Emplastrum Magistri Galfridi de Meldis quod dicitur manus Dei ", opening, " Recipe galbani onz. i armoniaci onz. ii opponaci onz. i . . .". Geoffrey (fl. 1310-1348) is the subject of Chapter 19 in vol. III of *Magic and Experimental Science*.

⁷³ Fol. 3v, " Contra pestem nobile remedium probatum et verum. Recipe diptani albi sandalorum rubeorum bolli armeniaci . . .".

pills⁷⁴. It further contains an astrological tract and unlucky days for each month⁷⁵.

* * * * *

A peculiar feature of manuscript Palat. 758 of the fifteenth century at the Biblioteca Nazionale Centrale of Florence is that few of its more than thirty constituent texts appear to be found in other manuscripts. Aside from verses, recipes and passages in Italian which may be extracts from better known works, there are only six entries of which other manuscripts are known to me. These are the treatise ascribed to Thomas Aquinas which opens, "Tuis rogationibus assiduis, frater karissime, tractatum brevem de arte nostra . . ."⁷⁶; the *Speculum alkimie* attributed to Roger Bacon which begins "Ad instructionem multorum . . ."⁷⁷; the alchemical verses ascribed elsewhere to Geber or Hermes⁷⁸, with the opening line,

Est fons in limis, huius latet anguis in ymis,

Geber *De perfectionis investigatione*; and two works attributed to Arnald of Villanova, the *Rosarius*⁷⁹ and what is here called "Pratica pulcherrima"⁸⁰.

Less familiar is the Book of Treasure which opens the manuscript and is there ascribed to Hermes⁸¹ and "Another work entitled Treasure of All

⁷⁴ Fol. 4r, "Pillule Adidem. Recipe aloes secultrum . . .".

⁷⁵ Fols. (unnumbered) 34r-35r, "Mensis Ianuarii habet signum Aquarii. Qui natus fuerit amichabilis erit iocundus . . ." and so for the other months. The unlucky days for each month follow, after which the text consists of recipes which are chiefly medical.

⁷⁶ To those listed in my *History of Magic and Experimental Science*, III, 137, note 54, and p. 42, note 4, may be added Vatican Palatine Latin 1332, 15th century, fols. 13r-14v: "Incipit tractatus beati Thome datus fratri Remaldo ordinis predicatorum", with the different opening words, "Carissime frater, volo te in tribus habere precautum . . .", and the colophon, "Explicit tractatus beati Thome de Aquino ordinis Predicotorum de multiplicatione editus datus suo socio et dilecto fratri Remaldo eiusdem ordinis pro thesauro secretissimo". The work is here divided into eight chapters, and the other variant incipit, "Recipe igitur mercurium minerale . . ." (*op. cit.*, p. 42, note 4), occurs at fol. 13v in the course of the second chapter, "De mercurii compositione et eius preparatione", and opposite it in the margin is written, "Incipit practica".

⁷⁷ A. G. Little, *Roger Bacon Essays*, 1914, p. 413, No. 53.

⁷⁸ D. W. Singer, *Catalogue of Latin and Vernacular alchemical manuscripts*, Nos. 791, 824, at II, 512-14, 565-66.

⁷⁹ *A History of Magic and Experimental Science*, III, 669-71.

⁸⁰ *Ibid.*, 657-58 and 659-60. The pope addressed is here called Clement (fol. 102v, "Dixi tibi ergo Clementi quod oportet primo corpora in primam materiam reducere . . ."), so that it would seem that the work is *Errores alchemiae* rather than *Epistola ad papam Bonifacium VIII*. For the incipits and desinits see Ministero della Pubblica Istruzione, *Indici e Cataloghi*, IV, *I codici Palatini della R. Biblioteca Nazionale Centrale di Firenze*, II, iv, 289.

⁸¹ Palat. 758, fols. 4r-6v, titulus, "Incipit quidam tractatus Hermetis phylosophi super sapientia triplici in arte libera quam hominibus celaverat sapientibus; et vocatur iste Liber thesauri sui, qui quidem postposito prohemio sic incipit"; incipit, "Fili, accipe in nomine domini de tartaro crudo quantum volueris . . ."; desinit, "... cognoscetis et deo gratias agite et cetera".

Books", which immediately follows it and by the Catalogue is also attributed to Hermes⁸². Equally infrequent is a brief (fol. 9r-v) "Ad albumet rubeum", ascribed to "Sanctus Thomas de Aquino"⁸³. Passing over a bit of only eleven lines of text, opening, "Ars alchimiae constat ex quatuor spiritibus . . .", we come to the book of King Rogiel, who, although here represented as a disciple of Hermes, seems to be otherwise unknown to the annals of alchemy⁸⁴. Nor is the incipit of the book of Philo the philosopher recorded for any other manuscript⁸⁵. *Liber sacerdotum* is a title found elsewhere for alchemical treatises⁸⁶, but the incipit, "Sacerdotibus Iovis magnifico regi Alkimie famulantibus . . ." seems confined to this manuscript⁸⁷. The same is true for A Perfect Practice extracted from the Secret of Secrets of Alchemy⁸⁸. Some of its sub-headings may be noted:

- Fol. 24v, De proprietatibus aquarum et primo qualiter fiat ex eis distillatio.
- Fol. 25v, Sublimatio quid sit (other processes follow).
- Fol. 28v, Nunc dicendum est aliqua de spiritibus.
- Fol. 33r, De aquis terbentine distillatis.
- Fol. 33v, De fusione lapidis ematis (repeated at fol. 34v).
Ut es in lunam convertatur.
- Fol. 34r, De rubificatione cuiuslibet corporis.

A brief tract on waters opens, "Aque acute ad album sunt hec . . ."⁸⁹.

Three treatises which follow, and which are represented in the Catalogue as anonymous, are found, so far as I know, only in this manuscript. The first is a Proof that Alchemy is a Licit Art operating correctly and can truly be

⁸² *Ibid.*, fols. 6v-9r, titulus, "Aliud opus intitulatum Thesaurus omnium librorum"; incipit, "Iste parvulus liber est mei . . ."; desinit, ". . . faciendo ad modum supradictum sustinet omne iudicium. Explicit Thesaurus omnium librorum. Deo gratias".

⁸³ It opens, "Sublimavi multotiens mercurium ita ut esset fixum . . ." and closes, ". . . efficiebatur sole purius".

⁸⁴ Palat. 758, fols. 14r-15v: titulus, "Incipit Liber Rogielis regis"; the prologue opens, "Cum enim Rogiel rex, magistri Hermetis discipulus . . ."; text incipit, "Accipe ergo astulaxis . . ."; desinit, "laborare poteris preciosum. Explicit liber Rogielis regis".

⁸⁵ *Ibid.*, fols. 15v-16v: titulus, "Incipit liber Phylonis phylosophi"; incipit, "Professioni alkimie artis vacantes librum hunc legant . . ."; desinit, ". . . et habebis lunam speciosam".

⁸⁶ See Thorndike and Kibre, *A Catalogue of Incipits*, cols. 73, 633, 672, 743.

⁸⁷ Palat. 758, fols. 16v-17v, ending, ". . . et habebis solem preciosum". The resemblance to the desinit of the preceding tract ascribed to Philo suggests that they belong together. "Segreti varii d'Alchimia" follow at fols. 17v-24r, but thirty of them are in Latin and only two in Italian.

⁸⁸ *Ibid.*, fols. 24r-35r: titulus, "Incipit quedam Pratica perfecta ex secretis secretorum alkimie extracta brevi sermone hic supponit absque fallacia vel errore"; incipit, "Ad ministracionem (not administrationem, as in the Catalogue), multorum hoc secretum scire cupientium . . ."; desinit, ". . . sive fermentum et habent intentum domino concedente".

⁸⁹ *Ibid.*, fol. 35r-v. The Catalogue has, "Aque acute ad Album et ad Rubeum", but "Ad Rubeum" comes only at fol. 35v.

accomplished ⁹⁰. The next is Second Operation, which is Sublimation of Spirits ⁹¹. Rubrics occurring in the text are

- Fol. 37r, Accipe litargirii aureum partem et tere bene. De coagulatione mercurii Vts. Accipe de sale communi preparato et de sale gemma et de sale armoniaco.
- 37v, De preparatione salis communi.
De purgatione reductione et coagulatione mercurii ad album sive rubeum.
- 38r, De sulphure predicto.
- 39r, Si vis procedere ad rubeum.
De oleo communi distillato.
- 39v, De congelatione Mercurii ad lunam faciendam.
- 40r, De eodem.
De faciendum (*sic*) lunam de urina.
- 41v, Ad componendum solem.

The third treatise, although entitled “Pratica Alkimie sub compendio”, is none the less the longest of the three ⁹². Moreover, while the author is not named in the Catalogue, he mentions himself in the text as Emanuel de Soncino of the diocese of Cremona. He holds that theory is of no avail without practice but professes, however, to follow the ancient philosophers, especially Hermes ⁹³. The work is in two parts on the preparation of bodies and the preparation of spirits. In the former six operations are necessary: ablution or purgation or separation, calcination, purgation of chalk, its sublimation, imbibition, and its reduction. Under the first he considers the purgation of Saturn, Jupiter, and the other metals under their planetary names. Calcination is defined as “the ultimate division into indivisible parts which it is impossible to divide further, like the atoms which are at the center of the sun (gold) which have no part” ⁹⁴. In the preparation of spirits ⁹⁵ six operations are likewise

⁹⁰ *Ibid.*, fols. 35v–36v: titulus, “Probatio quod alkimia sit ars licita recte operando et vere possit fieri”; incipit, “Sciendum namque quod metalla in se differunt solum per accidens . . .”; desinit, “. . . de substantia illa”.

⁹¹ *Ibid.*, fols. 36v–42r: titulus, “Secunda operatio que est sublimatio spirituum”; incipit, “Mortificatio mercurii secundum Hermetem sic fit . . .”; desinit, “. . . ut lustrum capiant et colorem naturalem”.

⁹² *Ibid.*, fols. 42r–61v (rather than 62r as given in the Catalogue): incipit, “Sapientiam omnes naturaliter appetunt et eius fructum consistere in aquisitione rerum ipsarum . . .”; desinit, “. . . aluminis roze partes duas et resolve nec ultra inveni”.

⁹³ *Ibid.*, fol. 42r: “Ego H̄emanuel de Soncino Cremone dyocesis ad mei socii petitionem ea que ad frequentem usum artis alkimie necessaria sunt compendioso tractatu tradere proposui, in omnibus tamen sequens dicta antiquorum philosophorum et maxime Hermetis pastoris philosophis”.

⁹⁴ *Ibid.*, fol. 51v: “Calcinatio est ultima divisio in partes indivisibilis quas impossible est ulterius dividere, sicut athomi qui sunt in medio solis quibus non est pars”. The fourth, fifth and sixth operations are disposed of rapidly at fol. 52r.

⁹⁵ *Ibid.*, fol. 52v: “Incipit 2a pars huius opusculi de preparatione spirituum. Sed oportet in preparatione spiritus ut sit bonus elixir lapis seu medicina ad prociendum in quolibet corpore prius preparato et fuso”.

necessary: namely, ablution, sublimation, calcination or fixation, ceration, solution, and congelation or coagulation. Ablution is taken up first for mercury, then arsenic, sulphur, sal ammoniac, and tartar. Under sublimation we have that of mercury *ad album* and *ad rubeum*⁹⁶, that of arsenic and its rectification according to Hermes⁹⁷, and that of arsenic *ad album et ad rubeum*⁹⁸, and that of sulphur according to Hermes⁹⁹. After a single paragraph on calcination, the work appears to break off unfinished¹⁰⁰.

After the *Speculum alkimie secundum philosophum*, which is more usually ascribed to Roger Bacon, as has been said, comes a Book of Waters with an unfamiliar incipit¹⁰¹. Some of the captions in the text may also be noted:

- Fol. 67r, Sequitur de aqua fixitiva.
- 67v, Sequitur de aqua resolutiva.
- Sequitur de bona aqua afincar.
- 68r, Sequitur de aqua rectificativa salis armoniaci.
Aqua salis armoniaci fixa posita in aqua ovorum rectificata fixat omnes spiritus et dissolvit.
- 68v, A far biancho lo ramo.
Ad dealbandum Venerem.

Eleven secrets to make silver which follow at fols. 68v–70r are catalogued as a distinct text. Nine of them are in Latin, two in Italian. In connection with a *Pratica* on the philosophers' stone by Daniel Amatutes, the Catalogue has chiefly noted its Italian verses, but it may be described somewhat differently in Latin¹⁰². Alchemical verses which open "Buffonum si quis virtutem nosceret unam"¹⁰³, are perhaps known only through our manuscript, and likewise a *Pratica* in four works which immediately follows them¹⁰⁴. The

⁹⁶ At fols. 54r and 55v.

⁹⁷ Fol. 56v.

⁹⁸ Fols. 57v, 60r.

⁹⁹ Fol. 61r.

¹⁰⁰ At fol. 61v. There follow "Pulvis bonus pro consolidando", "Ad componendum aliquod boracem contrafactam"; fol. 62r, "Ad faciendum boracem pro saldeno"; fol. 62v, "A far polvere de boraxo. . . . A far sal armoniacus. . . . A far argento . . ."; fol. 63r, "Medicina ad album".

¹⁰¹ Fols. 67r–68v: "Incipit liber aquarum. Et primo de aqua resolventis spiritus. Accipe alumen iameni et sal . . .".

¹⁰² Fols. 70v–75r: "Incipit practica de lapide philosophica secundum Danielem Amatutem que bona relata est ut cuiilibet apparebit intuenti. . . . Et me vivente a malis liberari. Amen. Explicit pulcra et vera practica de lapide philosophyco. Laus deo." There follows an "Expositio versuum, 'El me dilecta . . .'" from fol. 75r to 76r. For an ensuing *Pratica* in Lullian style of 18 endecasyllabic verses see the Catalogue. Then, at fols. 76v–77r, "Expositio antedictorum versuum".

¹⁰³ At fol. 77v.

¹⁰⁴ At fol. 77v–78v: "Incipit alia practica nobilissima que fit modo infrascripto vz. (fol. 78r) Nota opus pulcrum. Primo recipe mercurii vi et Iovis tamquam fermentum usque in perpetuum, Finit practica suprascripta, dei gratia."

following brief item, which is hardly noted in the Catalogue, may be reproduced in full :

At fol. 79v, Ad lunam alia praticha

Maria mia sonat breviter que talia donat
 Luminis cum bonis fugitivum figit in ymis
 Horis in trinis tria vincula fortia funis.
 Maria, lux roris, ligam ligat in tribus horis
 Filia Plutonis consortia iungit amoris
 Laudet massata quando tria sunt sociata.

"Ad faciendum argentum ad ligas decem" has the unfamiliar incipit " Recipe de calce viva et de cinere cerrii . . ." and a " Nota de tribus lapidibus in quibus est principalis ars " opens, " Item sunt tres lapides principales in arte . . ." ¹⁰⁵. We are also told, " Nota experimentum domini de Farnesburg (?) de luna et terminatur uno die " ¹⁰⁶. " Fixatio congelationis Mercurii " presents a new incipit in " Recipe lanciolam tartarum album pistum item parum boracis . . ." ¹⁰⁷ and the opening, " Primo oportet lavare mercurium id est argentum vivum isto modo . . ." for " Si vis facere lapidem philosophicum qui dicitur Elixir " ¹⁰⁸, seems found only in this manuscript.

The Catalogue represents fols. 151v-201v as containing a single *Pratica di Alchimia* in the vernacular which opens, " Mosso da una licita consideratione . . . ". But at fol. 183v we read, " . . . nel nostro trattato grande . . . Vale. Laus deo ". Then come rectangles filled with letters of the alphabet and what each indicates in alchemy. At the top of fol. 184r is written, " Et per clare forma de questo glorioso et feto magisterio . . ." ; at fol. 189r, " . . . & al proposito de nostro magisterio sel non e nato dell' metalli ". An alchemical alphabet follows, and another one on 189v. Then a new treatise begins : " In nomine domini eterni dei Ista praticha dividitur in quinque partes : 1, de menstruis maioribus ; 2, de creatione Mercurii maioris ; 3, de dissolutione ; 4, de separatione ; 5, de unione." But after this Latin introduction, the text is in Italian. It cites Raymond at fols. 190v, 193r, and 194r, and ends at the bottom of fol. 195v. Ensuing rubrics and incipits are as follows :

196r, rubric, " Compositio cum cccc minerali " ; incipit, " Recipe una parte de gama de lion . . . ".

rubric, " De modo calcinandi solem et lunam " ; incipit, " In nomine dei pigliati tanto B che fia fatto ad modo de Raymondo . . . ".

196v, five rubrics which I omit.

197r, rubric, " De lavatione ignis et terre ".

197v, rubric, " De unione mercurii cum sulphure ".

" De phylosifim (?) solutione."

198r, rubric, " De modo preparandi corpora pro multiplicando sulphure ".

198v, two rubrics which I omit.

¹⁰⁵ At fols. 80r and 84r.

¹⁰⁶ At fol. 85v.

¹⁰⁷ Fol. 101r.

¹⁰⁸ At fols. 148v-151r.

199r, rubric, "In nomine domini nostri Iesu Christi fractanta (?)
Iohanne de Rupe sissa"; incipit, "Fili accipe vinum
rubeum et melius quam poteris . . .".

200r, rubric, "Canon secundus".

200v, rubric, "Canon tertius".

201r, rubric, "Canon quartus".

201v, rubric, "Canon quintus" but it breaks off unfinished and the
MS. ends.

* * * * *

The contents of manuscript Palatine 945 of the Biblioteca Nazionale Centrale at Florence include works, extracts and fragments in not less than thirty different hands and from four centuries, the thirteenth, fourteenth, fifteenth and sixteenth, in four main fields of alchemy, medicine, geomancy and magic. Three of the four geomancies are of the thirteenth century, including that attributed to Gerard of Cremona, and three are anonymous¹⁰⁹. The rest of the manuscript is of the later centuries. What is here entitled "A Book of General Magic" (*Liber magiae generalis*, at fols. 102r-135r) is seen from its incipit, "Lapis benedictus fit ex una sola re . . ." to be alchemical. In another manuscript, these words introduce the second book of an alchemical text ascribed to Jean de Meun¹¹⁰, but the desinits are different. The other alchemical text of any length in our manuscript occurs in the portion of it which was once MS. Stroziana 655 (56), is anonymous, probably written in the sixteenth century, and does not seem to be found elsewhere¹¹¹. It cites Albertus Magnus¹¹². Aside from two treatises on magical images, suffumigations and the like¹¹³, and a brief interpretation of dreams, the rest of the manuscript contains a great many recipes and secrets in Latin and in a number of Italian dialects.

* * * * *

¹⁰⁹ For their incipits (also in *A Catalogue of Incipits*) and desinits see Ministero della pubblica istruzione, *Indici e cataloghi*, IV, *I codici Palatini della R. Biblioteca Nazionale Centrale di Firenze*, II, vi (1899).

¹¹⁰ D. W. Singer, *Catalogue of . . . Alchemical Manuscripts*, I, 283, No. 301, in London, British Museum, Sloane MS. 976, 15th century, fols. 93v-108v. Yet another MS., in which it is anonymous, is Vienna 5509, 15th century, fols. 47r-60r.

¹¹¹ At fols. 186r-206v: titulus, "Liber alchimiae ab amore charitateque editus in quo errores hominum demonstrantur mendaciaque deterguntur et per eum verum a falso discernitur"; incipit, "Cum cognovissem meos et alienos errores . . ."; desinit, ". . . omnia quae tentaverit in eius dolorem damnum et verecundiam redundabunt".

¹¹² Fol. 191v, "Et Albertus et alii dicunt . . .".

¹¹³ At fols. 169r-185v, of which fols. 169r-176v, containing the first treatise in Italian, are 16th century, and fols. 177r-184r, the second treatise in Latin, are on paper, 15th-16th century, in faint writing. "Suffumigatio ad videndum in somno . . ." is a heading, not the incipit, as one might infer from the Catalogue. The true incipit is, "Recipe sanguinis asini congelatim (?) pinguedinis lupi . . .". Then follow other recipes: "Ad ludum, Ad inimicitiam inter duos excitandum sempiternum, Ad amorem", etc., which are numbered in the margins up to xxvii on fol. 180r; then the caption, "HORDO (fol. 180v) nomina et carasteres signorum" (with characters).

From an examination of Bernardus de Grana (?), *Super Arnaldum de Villanova*, in Riccardian manuscript 386 (N. III. vii in Lami's catalogue of 1756), a small quarto on paper of the sixteenth century¹¹⁴, it becomes evident that correction is required in the cataloguing of what has hitherto been called his commentary upon Arnald's *Parvum Rosarium* (usually entitled, *Perfectum magisterium*)¹¹⁵. In the Riccardian manuscript, "Ingenium etc." are seen to be the catch-words of the passage from Arnald upon which Bernard comments. The incipit of his commentary is rather, "Huius mercurialis sublimatio requirit scientiam totius philosophie que tamen sub quatuor terminis brevi eloquio tibi narrabitur . . .". The alchemical bibliography in Vatican Barberini Latin manuscript 273 made "confusion worse confounded" by representing Bernard's commentary to be on Arnald's *Rosarius* rather than *Parvum Rosarium* and by jumbling catchword and incipit together into "Ingenio huius inercurialis sublimationis . . ." apparently in an effort to make continuous sense out of them¹¹⁶. Moreover, it is dubious whether Bernard's commentary is on even the *Parvum Rosarium* (or, *Perfectum magisterium*). In the Riccardian manuscript, it does not seem to be mentioned, but passages from Arnald's text are alternated with exposition of them by Bernard¹¹⁷, and in one instance the passage which is cited from Arnald's *Speculum medicinale*, which is not even an alchemical work¹¹⁸.

¹¹⁴ At fol. 9r-47v (1r-39v, old numbering). The next leaf, now numbered 48, is blank and was unnumbered in the old numeration.

¹¹⁵ Lodovico Frati, "Indice dei codici latini conservati nella R. Biblioteca Universitaria di Bologna", *Studi italiani di filologia classica*, 16 (1908), 103-432, at pp. 210, 213, 223: MS. 270 (457), VIII, 4, "Bernardi de Grauia Commentum super parvo Rosario Arnaldi de Villanova", opening, "Ingenium ergo remotionis . . ." and closing, ". . . fidelibus praestolavit"; 270 (457), XV, X4, "Commentum Bernardi de Gravia super parvo Rosario Magistri Arnaldi de Villanova", opening, "Ingenium igitur . . ." and closing, ". . . docet excitative"; 303 (500), 15th century, fol. 1-62r. "Commentum Magistri Bernardi de Gama, alias de Grava super parvo rosario Magistri Arnoldi de Villanova", opening, "Ingenium igitur . . ." and closing, ". . . docet excitative". Followed in my *History of Magic and Experimental Science*, III, 56 and IV, 335, and in *A Catalogue of Incipits*, col. 351.

¹¹⁶ Vatic. Barb. 273, fol. 258r. As for *Rosarius*, however, see the next footnote.

¹¹⁷ For example, at fol. 18r (10r), "Sequitur textus Arnaldi capitulo cxiii" (no alchemical work by Arnald runs to that many chapters). "Ingenium ergo remotionis superflue ipsius terree substantie . . .". Nor do I find the citation in his medical works. Then, after 3 lines of Arnald's text, rubric, "Glosa magistri Bernardi."

However, in *Rosarius philosophorum*, as contained in the *editio princeps* (Lyons, 1504) of the *Opera* of Arnald of Villanova, Liber II, cap. 3 (II, 3 might be mistaken for 113), "Quomodo depuratur Mercurius et purgatur", opens at fol. 390va, "Ingenium igitur ipsius terree substantie superflue remotionis est ipsum semel vel bis sublimare . . .".

The incipit, "Ingenium igitur remotionis superflue . . ." is also that for Guido de Montano (Montaynor?), *De arte chymica*, in Hermannus Condeesyanus, *Harmoniae imperscrutabilis chymico-philosophicae*, Frankfurt, 1625, I, 125-152. For other alchemical works by Guido de Montaynor see his name and also Montena in the index to Thorndike and Kibre, *A Catalogue of Incipits*.

¹¹⁸ Fol. 34r (26r), "Textus Arnaldi in speculo medicinali". At fol. 42v (34v) we again have "Textus, Ingenium etc.", followed by the Expositio, "Auctor dicit quod artificium . . .".

This commentary of Bernard on Arnald is followed in the Riccardian manuscript by a long work by Raymond Lull which, however, is not alchemical but his *Fundamentum artis generalis*¹¹⁹, in which he holds forth on God and angels, then on the heavens, elements, qualities, man and the rational soul, and discusses many questions such as :

- Fol. 78r (87) Utrum angelus potuit intelligere deum in puris naturalibus.
- 81 (90) Per quem modum angelus angelum et alias res intelligit.
- 83 (92) An Lucifer fuerit maior omnibus angelis.
- 84 (93) Unde corporeitas habet ortum.
- 95r (104) Quomodo scientia medicine possit duci ad principia generalia.
- 95v Quomodo medici possunt habere cognitionem de gradibus infirmitatum.
- 99r Sequitur Chaos (a Lullian concept and title).
- 101v (110) Utrum anima brutorum sit de aliquo.
- 104v (113) Quomodo Eva abstracta fuit ab Ada.

At fol. 108r (117) Raimundus is twice represented as speaking.

The remainder of the manuscript¹²⁰ consists mainly of letters in Italian written from Naples by Franciscus del Nero in 1542.

* * * * *

The manuscript in the Riccardian Library as Florence which is now numbered 390 (N.III.xi in Lami's catalogue of 1756) is a collection of alchemical treatises which deserves description and has been little noticed¹²¹. It is a small paper quarto of 165 leaves written for the most part in a hand of the sixteenth century, although perhaps in part of the fifteenth. The first treatise in the manuscript is the *Rosarius minor* at fols. 1r-18r, recognizable from its incipit, " Descendi in hortum meum ut viderem plantas . . . ". Next, at fols. 21r-28v, comes the *Testamentum* of Arnald of Villanova, opening, " Ego Arnaldus de Villanova incipio istum librum in nomine . . . ". At fols. 30r-32r are figures of alchemical apparatus and a diagram and tree in the style of Raymond Lull. Fol. 32v is blank ; on 33r begins in Italian, " Renaldo de Vila nova. Che fermentis doro sic oro e fermento dargento sic argento ". The *Questiones* of Arnald in Latin occupy fols. 34r-40v, with the following openings of the two parts, and explicit of the whole :

Fol. 34r, Incipiunt questiones tam essentiales quam accidentales magistri Arnoldi de nova vila De compositione lapidis. Primo queritur si compositio lapidis potest fieri ex solis luminaribus et aqua vite aut ex uno luminari et aqua vite . . . *

¹¹⁹ At fols. 49r-117r (old numbering, 40r-108r) : " Deus cum sua sapientia charitate et amore Incipit fundamentum artis generalis ad dei laudem cognitionem et amorem." Incipit, " De natura anime rationalis est naturaliter intelligere . . . ".

¹²⁰ At fols. 109r-141r (118-155). Fols. 112r-122v (122-133) are religious.

¹²¹ In my *History of Magic and Experimental Science* it was mentioned only at III, 675 in connection with the *Testamentum* of Arnald of Villanova and on the basis of Lami's catalogue.

Fol. 38r, Incipiunt questiones accidentales. Quot furnoli (?) sunt necessarii ad hanc artem . . .

Fol. 40v, Explicant questiones tam essentiales quam accidentales magistri Arnoldi de villa nova et penes (?) Bonifacio pape sunt declarate que quantum sunt declaratione totius artis etc.

The next rubric in our manuscript announces the *Epistola accurtationis* of Raymond Lull, but the incipit, " Recipe (or, Accipe) nigrum nigrius nigro . . ." is that of the third chapter of his *Ars magica* : fols. 41r-44v, " Incipit epistola Acurtationis lapidis benedicti Magistri Raymundi de insula Maioricarum. Recipe Nigrum nigrius nigrior (*sic*) Explicit ". The *Epistola* is then announced again, this time with its correct incipit, and is followed by the Compendium of the Magic Art or *Ars magica* ascribed to Lull :

Fols. 45r-48r, Incipit Epistola Accurtationis clarissimi Raymundi philosophi. Cum ego Raymundus de insula Maioricarum . . . (Fols. 48v-49v are blank.)

Fols. 50r-58v, Incipit Compendium artis magice secundum cursum nature Explicit ¹²².

Our manuscript now turns away from Arnald of Villanova and Raymond Lull to the Emerald Tablet of Hermes and commentaries of Ortolanus thereon :

Fol. 59r, Incipit Epistola Hermetis super operationem lapidis philosophorum. Verum sine mendacio . . .

Fol. 59v, Expositio Ortulani super epistolam Hermetis. Dicit ergo philosophus, Verum sine mendacio, id est, verum est quod ars est vera ending at fol. 65v.

Fol. 65r, Liber Ortulani. Dixit philosophus, Accipe ergo lapidem benedictum qui non est lapis nec de natura Explicit (at top of fol. 70v).

The next tract, at fols. 70v-72v, opening, " Si vis facere aquam vite ad vitam hominis conservandam . . ." is sometimes attributed to Lull ¹²³. The treatise which follows it seems unfamiliar :

Fols. 73r-76v : rubric, " Incipit operatio et immissio lapidis albi trium substantiarum " ; incipit " Recipe, lapidem album et ipsum totum in aquam communi (*sic*) . . ." ; fol. 74r, rubric, " Incipit operatio et divisio lapidis rubei animalis . . ." (fol. 77 is blank).

The *Semita recta* ascribed to " brother Albertus Magnus of Cologne ", occupies fols. 78r-110r, with figures of apparatus sharing the pages with the text at fol. 87r-v. Then fols. 112r (old numbering, 110)-125v are filled by a Philosophy of the Palms : rubric, " Abreviatus liber qui intitulatur Palmarum

¹²² For these works ascribed to Lull see further *A History of Magic and Experimental Science*, IV, 623-24, 630-31.

¹²³ See *A Catalogue of Incipits*, col. 676.

Philosophie (*sic*) ” ; incipit, “ Aurum est preciosius metallorum et in tinctura rubedinis . . . ”.

A treatise by a Nicolaus Anglicus opens at fol. 126r, where, after two lines of invocation, the text proper begins, “ Ego Nicolaus Anglicus volo propalare et manifestare illud quod pater filio denegavit . . . ”. It is less easy to determine where it ends. At fol. 127v we read, “ Nunc dicendum est de practica ”, and at the bottom of fol. 129r, “ Veniamus ad proiectionem ”; but the work may end at 129v or go on to 131r. At fol. 131v we have Hortulanus again, “ Incipit practica theorice. Dixit philosophus, Accipe ergo lapidem . . . ”.

Book of Three Words was a common alchemical title and various texts with that designation were ascribed to Kalid rex or Khalid ibn Jazid, Rasis, Roger Bacon, Rudianus and Racaydyby. In our manuscript one with a new incipit is attributed to Hermes :

Fols. 133r–136r, rubric, “ Hic est liber trium verborum Hermetis ” ; incipit, “ Recipe lapidis preciosi quod est corpus aereum et volatile . . . ” (fols. 136v–137v are blank).

At fols. 138r (old 136)–144r, the *Speculum secretorum* of Roger Bacon opens “ Ad instructionem multorum tractantium circa artem istam . . . ” (at fol. 143v, “ De sexta et ultima operatione ”), followed at fols. 144v–150v by his *Liber claritatis*. Blank pages then intervene before the last text in the manuscript, at fols. 154v–165v, “ Practica Hermetis philosophi pulcrissima in principio medio fine de lapide philosophorum qui bene intelligit eam. Et si intelligis, non errabis ”.

* * * * *

According to the old catalogue of Lami (Giovanni Lami, *Catalogus codicum manuscriptorum qui in bibliotheca Riccardiana Florentiae adservantur*, Leghorn, 1756, p. 122, what was then MS. L.I.xix and is now Riccardian 944, contained an Exposition of Rachaidibi, son of Cechedibi, on the holy gift of God. But it and other treatises listed by Lami as follows no longer appear in the MS. :

Receptae medicinales plures.

Liber Rubiani (*sic*) regis Persidiani qui dicitur Flos florum alchimiae. Expositio Rachaidibi filii Cechedibi de sancto Dei dono.

Secretus liber allr (*sic*) editus a Magistro Rogero Lombardo experto et commendato in arte Siciliae per Imperatorem Fridericum qui dictus est Barbarossa.

Recepta Magistri Gofendi Neapolitani.

The MS. as now constituted opens at fols. 1–12r (old 51–62r) with *Rosarius minor* and continues at fols. 13r–42v (old 116–145) with the account of alchemy by Vincent of Beauvais in the *Speculum naturale*. Probably the above-named treatises occupied the old leaves 1–50 and 63–115.

* * * * *

The last codex which we have to consider, Riccardian 2067 (S.III.xii in Lami's catalogue of 1756), is a manuscript on paper in a hand or hands which

appear to be of the sixteenth century but contains a book of secrets in Italian said to have been made by or for Ruberto di Guido Bernardi on May 10, 1364¹²⁴. It is a discontinuous collection written in different hands and with occasional blank pages or spaces. Besides borrowings from the *Secretum secretorum* of the pseudo-Aristotle¹²⁵, and metallurgical or medical recipes such as " Segreto per pagliare ferri " and " A stangnare sangue "¹²⁶, there are " Parole per guarire la gotta sciatica "¹²⁷, and a prayer to staunch the flow of blood¹²⁸. Presently we come to divination from the Kalends of January, a Moon book, and Egyptian days¹²⁹, and then to the virtue of stones¹³⁰.

¹²⁴ In fronte codicis, " Questo libricuolo di Ruberto di Guido Bernardi fatto a dè X di Maggio 1364 ".

¹²⁵ Fol. 13r, " Dicit filosofo in libro de secretis il quale mando al Alessandro "; 22r, " Dicit filosofo in libro di segreti de secreto . . . ".

¹²⁶ Fols. 6v, 8r.

¹²⁷ Fol. 13v.

¹²⁸ Fol. 20r. Such prayers continue to fol. 21v. A number of leaves have been cut out between fols. 31v and 32r.

¹²⁹ At fols. 35v-36r, 36r-38v, 39r-v.

¹³⁰ At 40r, and after two blank leaves at 43r. The MS. ends at 45v.

THOMAS HARIOT'S SECRET SCRIPT.

By E. SEATON.

IN the eleven great folio volumes of papers left by Thomas Hariot, the Elizabethan scientist and mathematician (British Museum, Harleian MSS., 6001–2, 6083; Additional MSS., 6782–9)¹, there are several examples of a curious script, which no writer on him seems to have thought it worth while to notice, still less to investigate. Thus Henry Stevens did not mention it in his life of Hariot.

This curly, looped writing occurs chiefly in jottings and scraps; the most frequently found words in it are two which look like a name. Since they occur, with one slight variation, written large on a neat manuscript title-page in the last volume (Add. 6789, fol. 7) they carry conviction of being a signature. (See Plate III, Fig. 1.) Thomas Hariot's name is very nearly what he himself would probably have recognized as a mystical circular name. It begins and ends with the same letter, and it has the vowels o and a repeated in reverse order; the frequent omission of i or y in the script (as here) may have been meant to increase the palindromic effect. Hariot evidently then played the school-boy trick (played also by Dr Dee in his diary with Greek script) of transliterating English words to disguise them. Several alphabets and series of letters in this script occur in the manuscripts, but even in these private papers Hariot was wary and did not provide the English alphabet to de-code them.

Purchas was to comment on the private cyphers intended "to impound or pale in . . . secrets or mysteries of State or Art". Alchemists are said to have adopted Eastern writing for their *arcana*; and the Oriental Room in the British Museum reported on this script that it was "nearly certainly Armenian". This identification proved to present more problems than it solved, more even than the script itself afforded. From the signatures eight letters were to hand, a, h, m, o, r, s, t (or th), and y; t and th have the same symbol. Later the names of Waller Warnier (Add. 6789, fol. 494 verso, see Plate IV, Fig. 2) and of N. Torporley (Add. 6787, fol. 241 verso), Hariot's fellow-workers under the ninth Earl of Northumberland, were discerned among the scrawls. The small stock of letters was thus augmented by e, l, n, p, and w, but still comprised barely half the alphabet. At this point, Professor Dover Wilson rendered timely aid by reporting that Torporley manuscripts are still extant in the library of Sion College. Among these were found two sheets of statement in this same script, one dated 1590 with the month September, which added the letter b. Gradually from these two coherent statements, one of which was

¹ A twelfth volume was, and may be still, among Lord Leconfield's manuscripts at Petworth; this I have not seen.

obviously a recipe, the whole alphabet was obtained. It is as follows : size alone distinguishes between capitals and small letters.

ALPHABET

a	ə	æ	ər	o	e	ɔ	əʊ
b	ɛy			p	ɛy		
c	ɛy			q	? as for cw		
d	ɛy			r	ɛy	ɛy	
e	ɛ			s	ɛy		
f	ɛ			t th	ɛy		
g	ɛy			u [oo]	ɛ		u [iu] ɛy
h	ɛ			v	ɛ		
i ? j	ɛ			w	ɛy		
k as for c				x as for cs			
l	ɛy	ɛy		y	ɛy		
m	ɛ	ɛ		z	ɛy	ɛy	
n	ɛ	ɛ	ng				

The two statements, when deciphered, proved to be alchemical recipes, the one for making spirit of wine, with a drawing of apparatus, the other for making pewter:

For spirit of wyn. d. Turn^{r.}

Undr. A a fyr to rayz flem and spirit:

Undr^r. B, a gent. fvr to rese the flem.

tip up [t]he spir[i]t [t] hat it may pas into C

(Arc I, 4)

(A.R.C. L. 40. Z/E.6., fol. 97 verso.)

Canon
Triangulorum Nauticorum.



Thomas Harot

Add 6789

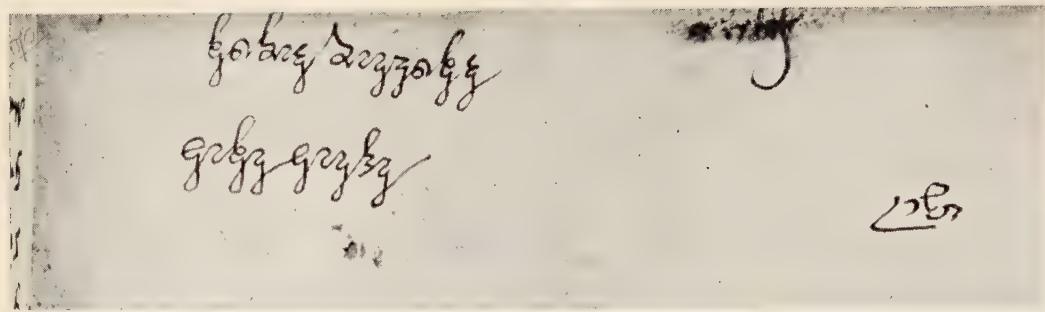


Fig. 2.—(Add. MS. 6789, fol. 494 verso) Thomas Haryots Watr Warnr.

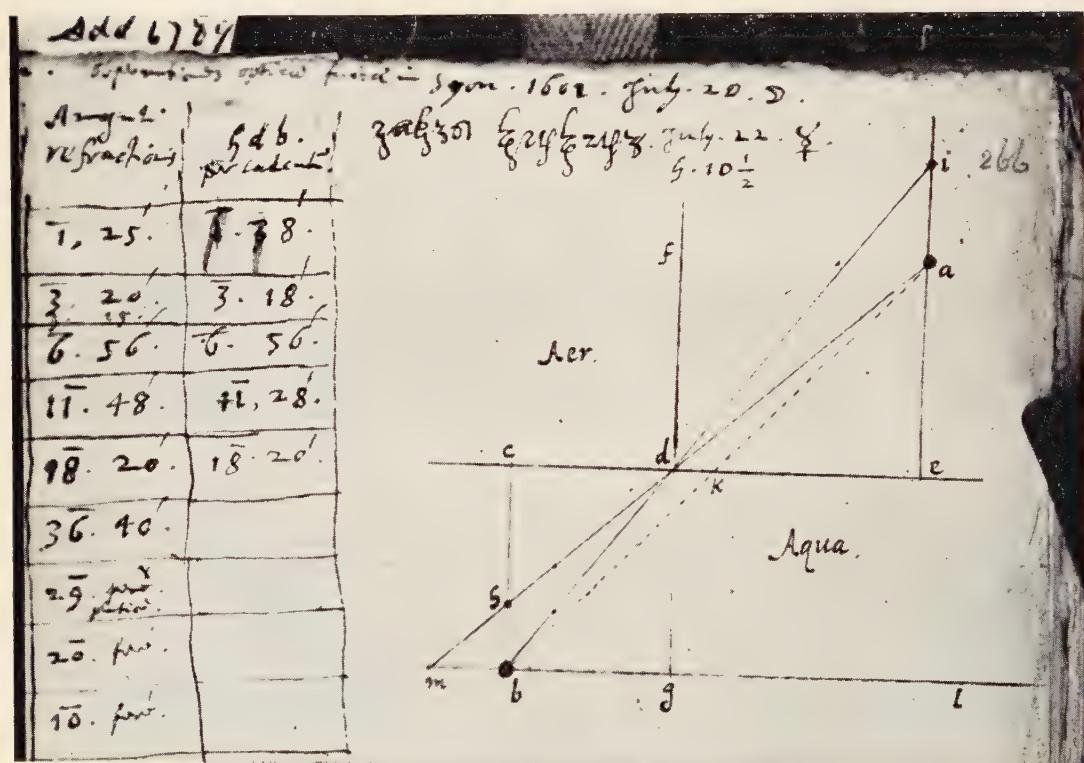


Fig. 3.—(Add. MS. 6789, fol. 266) ratyo calculy, dated July 20, 1602 at Syon [House].

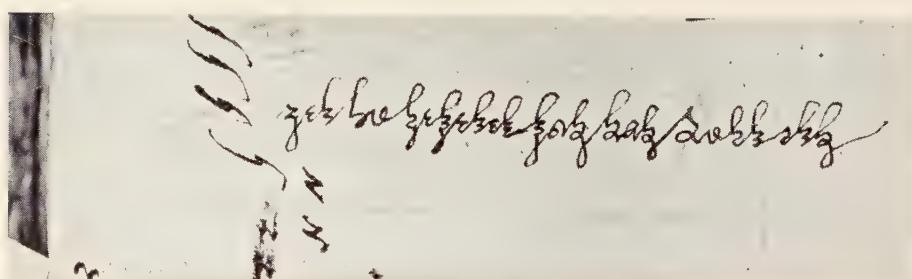


Fig. 4.—(Add. MS. 6789, fol. 494 verso) yin [t] he bigining god mad Hevn and.

Furst tak a fat clay, and al to bet it with convenient instriwments til it bi so wel wroot as any poters muwld and in wurking of it cler it ov al stonz, hwen yow hav it so, then fil it az ful of flokz as may bi til it bi of a [g]od consistans, then put in so mucl [s]and or brik as wil mak it not cleving to yor hand./

[t]he comon menstruwim iz watr
 [t]h nekst iz al [i.e. ale] drenk
 [t]h best iz solt watr

doctr^r Turnr
 septembr. 1590.
 (Ib., fol. 96 verso).

One great advantage of this script to the user is that (like the Burmese characters) it looks deceptively similar both right and wrong way up ; and some of the scribbles in Hariot's papers are upside down (e.g. Add. 6789, fol. 49 verso). It is clear that Hariot and Torporley further confused the effect by running words together, using contracted forms of words, sometimes omitting vowels, and (Torporley especially) using archaic, or phonetic, or even wrong spelling. One has also to reckon with the writer's errors in omitting or mistaking a character ; thus in the pewter recipe Torporley writes ' sand ' as ' iand '. He may have been less skilled in the script than Hariot. Hariot uses the t character for t and th in his name, and only once uses the h character for th ; but Torporley appears to write ' he ' regularly for ' the '. Hariot sometimes transliterates a Latin heading, as in ' ratyo calculi ' (Add. 6789, fol. 266; see Plate IV, Fig. 3) ; another example occurs later, on fol. 390 : ' An yris videtur in puncto ynyonis (i.e. unionis).' He writes another name in the script, Randal Knevet, perhaps only as a *probatio pennae* (Add. 6789, fol. 49 verso). I suspect that he also used the Hebrew alphabet for the same purpose of transliteration ; on fol. 494 verso of the same volume, on the same page as many Hebrew scribbles, come in the looped script, the opening words of *Genesis*, "yin [t]he begining god mad Hevn and" (see plate IV, Fig. 4). This text is repeated elsewhere in the volumes in ordinary writing.

It is possible to suggest a source nearer to the interests of the period, for Hariot's secret script, in the Tyronian Letters (or Letters of Seneca), the late classical systems of shorthand ascribed to Tyro, freedman of Cicero. They were supposed to have been further transmitted and amplified for Christian use by St. Cyprian, Bishop of Carthage. Johannes Trithemius, abbot of Spanheim, after a chance find in 1497, started looking for manuscripts, and soon found a psalter in these letters, labelled indeed *Psalterium in Armenica Lingua*. In his *Polygraphia* he described this search, and printed some examples of the notation (ed. 1571, Sigg. Pp-Pp. 2 verso). Cardinal Bembo in 1513 wrote to Pope Julius II a description of those that he had seen in a manuscript of Hyginus. The modern student will find these facts and the richest reproduction of these

shorthand signs in the two hundred or so folio pages of the *Notae Romanorum Veterum, quibus Litera verbum facit Tullii Tyronis Ciceronis Liberti, et Annaei Senecae*, published in 1603 by the Dutch humanist, Janus Gruterus. These are too late to have been the source for Hariot and Torporley, since they are using the letters from 1590 onwards. Hariot may well have found them in a manuscript. It must be stressed that Tyronian Letters do not furnish merely or primarily an alphabet, since they are shorthand symbols for syllables, phrases, locutions, and words. Hariot must have selected some of the simpler, basic symbols, and framed his own alphabet for cryptic purposes ; for cursive ease, he substituted rounder forms for angular. Symbols similar to some of his will be found in Gruterus, p. 6 (for *brevis*), p. 26 (for A), p. 27 (for *go*), p. 81 (for *paulo ante*), p. 113 (for *lambit*), p. 117 (for *sub,*) and p. 122 (for *horret*). The most sustained likeness is perhaps to be seen in Gruterus' lists of names from classical geographers, pp. 136-44 ; Hariot was of course a student of geography, as of much else.

Literary references were my original quarry in the Hariot volumes ; I do not think that any such are concealed in the script, which was probably intended solely for scientific or alchemical findings.

I am indebted (as once before) to the President and Court of Governors of Sion College for their permission to print and to reproduce from the Torporley manuscripts in their possession.

JOHANNES BANFI HUNYADES.

A SUPPLEMENTARY NOTE.

By F. SHERWOOD TAYLOR and C. H. JOSTEN.

SINCE our article on Johannes Banfi Huniades appeared in the last number of *Ambix*, some new facts concerning this alchemist have come to our knowledge¹.

(1) According to *The Obituary of Richard Smyth*, ed. Sir Henry Ellis, Camden Soc., vol. xliv, 1849, p. 22, "Hans Honger, alias John Huniades, the chymist without Algate" died on 28 August 1646. Sir Thomas Browne's memory was therefore presumably at fault when he informed Ashmole in March 1654 that Dr. Arthur Dee (*d.* 1651) would have joined Johannes Banfi Hunyades, then in Amsterdam, on his way to Hungary about 1649 or 1650, if he had not "suddainely . . . heard that Hans Hungar was dead" (*cf. Ambix*, vol. V, Nos. 1 and 2, p. 48). There is no reason to doubt the correctness of Richard Smyth's note, and it may be safely assumed that Johannes Banfi Hunyades died at the age of 70, in 1646, a short time after his portrait was engraved by William Marshall.

(2) The vaults of St. Leonard's Church, Shoreditch, London, contain the monumental tomb of a son of our alchemist, who bore the same name as his father ("IOHANNES BANFUS HUNIIADES filius IOHANNIS BANFI HUNIIADIS Rivuliensis Hungari"). He died on 15 November 1696, at the age of seventy-five. The following facts can be inferred from the Latin inscription on the monument, which was erected by his sister, Elizabeth Benson (*d.* 1710):²

(a) The wife of Johannes Banfi Hunyades the elder, and the mother of the younger, was Dorothy, a daughter of Sir Francis Colton, of Kent.

(b) Johannes Banfi Hunyades the younger is described as "Regali [c]x stirpe natus", which confirms our conjecture that the family was descended from Matthias Corvinus Hunyades (1443–1490), King of Hungary (see *Ambix*, vol. V, Nos. 1 and 2, p. 52).

(c) The inscription on the tomb of Johannes Banfi Hunyades the younger praises the defunct as "Philosophus Consummatus et omnibus numeris absolutus Artis Spagiricae et professor et ornamentum", which proves that he was, like his father, an alchemist. The references to "Mr. Huniades" in MS. Aubrey 26, which we tried to assign to Johannes Banfi Hunyades the elder (*Ambix*, vol. V, Nos. 1 and 2, pp. 48–50), therefore clearly refer to the son.

For details of the monument in St. Leonard's, Shoreditch, see *London County Council Survey of London*, vol. VIII, *The Parish of St. Leonard, Shoreditch*, London, 1922, pp. 112–113, where the text of the inscriptions is reproduced. See also Plates 35, 37 to 41, *ibid.*

¹ For most of this information we are indebted to Mr. Edmund Esdaile's letter in *'The Times' Literary Supplement* of 9 July 1954.

² Her monument is in the same crypt. Its inscription describes her as "Clarissimi Philosophi Filia, Clarissimi Germana, Gente Paterna Atavis Pannoniae Regibus, Maternâ Equestribus Cantianis edita".

CHYMEUTIKE.
THE REAL HELLENIC CHEMISTRY.
By PROCOPIOS D. ZACHARIAS.

Introduction.

CHEMISTRY was originally included in the Hellenic natural philosophy. In ancient Greece men of unusual keenness of observation and logic, having a great store of knowledge and using it for the welfare of humanity, were called sages (*σοφοί*) and were highly venerated. In the time of Pythagoras the more sober expression philosopher (*φιλόσοφος*), friend of learning, was introduced. As Heraclitus said' “Φιλοσόφου ἐστὶ περὶ πάντων δύναυθαι θεωρεῖν”. “ It is peculiar to the philosopher to be able to consider everything.” Thus the philosophers were occupied with all branches of learning, and doubtless collaborated to some extent with practical men to improve and develop various processes by their method of research, which consisted, according to the definition of Heraclitus, of “ First making the observation with our senses and then thinking about the things observed in order to explain them and find their Logos, their relations, the laws governing them ”. The processes involving a change received the special name of *Metallike*. But other names were also given according to the aspect of the process in view, and therefore the name Chymeutike was adopted in the schools of Alexandria, where it had been raised to the rank of a science, well-ordered, coherent, and roughly corresponding to what we now call Chemical Engineering. This science was destroyed by the continued efforts of the Romans but remained alive in the pious tradition of the Hellenic people. When the Hellenes formed their Byzantine empire in the third century the Christian Chymeutes collected as much as they could and tried to reconstruct this beautiful science. Their writings remained almost unknown and unconsidered until in 1887-8 Berthelot¹ published a great number of them, from originals or copies, all badly preserved, together with translations and comments. Later Stephanides, in fourteen publications between 1903 and 1910, commented on and corrected the work of Berthelot, and by consideration of other sources threw much light on this obscure and misunderstood aspect of the history of chemistry. His contributions, collected into one volume, appeared in 1914².

¹ Collection des alchimistes grecs par M. Berthelot avec la collaboration de M. Ch. Em. Ruelle. Paris, 1887-8.

² Συμβολαὶ εἰς τὴν ἱστορίκν τῶν φυσικῶν Ἐπιστημῶν καὶ ἴδιως τῆς χυμείας, ὑπὸ Μιχαὴλ. Κ. Στεφανίδου. 'Εν' Αθήναις 1914, pages 230. (14 contributions of which the 3rd *Psammurgy and Chymia* appeared in 1906 and is the most important and is contained in pp. 19-75.)

With this as a basis, supplemented by other scattered evidence that he had collected, the author of this paper has been able to throw light on many details^{3, 4} hitherto misunderstood, and to present the following reconstruction of Hellenic *chymeutike*. It was outside hellenic territory that the hellenic 'chymia', in the hands of the Arabs in Spain, developed into Alchymia, and it is incorrect to give the hellenic chymeutes, who were called philosophers by oriental peoples, the name of alchymists, with all their aberrations and false aspirations originating from Egyptian and Arabian sources.

A. Metalloiosis. The Art of Metallike. METALLON.

To denote the changes undergone by substances, under definite conditions, so as to produce new ones capable to making useful articles, of which iron, copper, brass, lead and the like, as produced in primitive kilns, were the most interesting, the name of *metalloiosis* was formed, a word composed from the preposition *meta* (*μετά*) meaning between, with, after, or taking a different position or state, and the substantive *alloiosis* (*ἀλλοίωσις*) meaning altering, changing. The date of the first use of this term cannot be fixed for want of contemporary written documents; it is suggested that it gave us the concept of the metal, because the product of *metalloiosis* is in Greek *metalloioma* or shortly *metallon*. This word has been used metaphorically to designate also the mineral and the mine itself and we see in Herodotus, as well as in Strabo and Plutarch later on, that the word *metalla* means 'the mines'. This metaphor has also been extended to denote the galleries for searching and extracting the mineral, and a verb *metallao* (*μεταλλάω*) has been derived to denote the act of searching for minerals and, generally, inquiring and asking; it is used in this sense by Aristophanes. Later all these metaphors were replaced by special names and the name *metallon* was retained to designate the most important products of *metalloiosis*, such as iron, copper, brass, zinc, lead, viz. the metals. The derivation found in Pliny, *met-allon* (*μετ' ἄλλων*⁵ meaning 'with others', has no physical justification.

The art of preparing the metals and also other substances by *metalloiosis* has been called *metalloiotike* or *metallike*, meaning what we understand today as chemistry.

The process of *metalloiosis*, as mentioned in the fragments of the works of the Christian Hellenic Chymeutes, may be summarized in the following definition derived from quotations by Stephanides. "First the ingredients are broken and ground, and then they are liquefied⁶ to an homogeneous mixture either by

³ Heracleitos, la pensée scientifique hellène et la chimie, par P. D. Zacharias. X International Congress of Chemistry, 15–21 May 1938. (Vol. I, pp. 61–67.)

⁴ Η Ἑλληνικὴ χυμευτικὴ (ώς εξειλίχθη διὰ τῶν αἰώνων εἰς τὴν πειζαματικὴν καὶ τὴν ζνσικοχημείαν). A lecture delivered before the Technical University, Athens. Printed in 1945.

⁵ Dr Albert Stange. Das Zeitalter der Chemie in Wort und Bild. Leipzig, 1908 (p. 3).

⁶ Stephanides, p. 34.

heating them until they melt or by pouring on them liquids to dissolve them, in order to bring them into an intimate contact and provoke *metalloiosis*.'' Due attention was paid to the right proportions of the ingredients, and to the management of the substances. Thus the concept of chemical change is very old and of true Hellenic origin, and the name *metallike* should have been given to the science of chemistry.

B. CHYMIA. *Chymists. Chymicos.*

In Egypt, with its Hellenic colonists as well as its mercantile and scientific visitors, another development occurred. The winning of gold both from river alluvium and from mines was an Egyptian industry from 2000 B.C. or earlier. As gold occurs pure in the free state, disseminated in river sand deposits or dispersed in veins, *metalloiosis* was not required, for by a suitable washing process (*psammurgia*) it was obtained in the form of washed sand, consisting of more or less pure gold admixed with earthy material. The gold was in small irregular particles, leaves or fibres, a state which was metaphorically called *Chyma* (*χύμα*), a heap or quantity of unpacked material. A quantity of numbers has also been called *Chyma*, as we find in the writings of the chymeteus Stephanus, of Nicomachus⁷ and others; also a book of Zosimus, containing recipes of arts for teaching to women, bears the title *Chyma*. The preparation is designated in Greek by the infinitive *chymeuein* or the equivalent substantive *Chymeia* (*χυμεύειν, χυμεία*), meaning 'preparing a *chyma*'. This derivation was first suggested by Stephanides.⁸ Generalizations, metaphors and personifications were soon formed, to include also the processes of *metalloiosis* which were classed as processes of the abstract entity *Chyme* (*Xύμη*) and the first writer of chemical treatises has received the name *Chymes* (*Xύμης*) and became the mythical originator of this art. Also the rock from which pure tinsels of gold, the famous gold *chyma*, was to be prepared was called *chymia-earth*, a name which Plutarch cites as designating the land where it came from, Egypt. The phrase 'Chyma of gold' was also used to signify pure gold. As *chyma* also derives from the verb *cheo* (*χέω, ἔχνσα*), from its two roots two spellings of the word have been deduced, *Chymeia*, which has been mostly frequently used, and *cheimeia*, the *Chemia* of the latins. Later on, the spelling of *Chymeia* varied and so this word is found written as *χυμεία, χυμία, χημία, χεμία, χμημία*, etc. The meaning of *cheo* being to pour or to cast, the base metals obtained in a molten state by *metalloiosis* in furnaces were called also *chyla*, cast. When they were recognized as simple bodies gold was included. But gold was won in the condition of sand, *chyma*, and by extension all simple bodies have been sometimes called sands, *ψάμμοι*. Recent commentators attribute this confusion of *chyla* and sands to mystical assimilation. The men who practised the processes of *Chyme* were called, outside Hellenic territory and influence, *Chymists* and

⁷ Stephanides, p. 72 (quoted from *Νικομάχου Γερασηνοῦ Ἀριθμητικὴ Εἰσανωγὴ*).

⁸ Stephanides, p. 36,

Chymicos, names which do not derive from *chymeuin* but from *chymizo* ($\chi\mu\iota\zeta\omega$), which means 'seasoning' and comes from *chymos* ($\chi\mu\omega\varsigma$) juice and relates to the production of foods and medicines.

C. CHYMEUTIKE. *Chymeutes.*

As the making of *Chyma* is called *chymeuin*, the men practising the processes of *Chyme* came to be officially called *Chymeutes* and their art *Chymeutike* from about 321 b.c. in Alexandria, where, under the reign of the Ptolemies, it was cultivated together with the other arts and raised to the rank of a well-ordered science, which was taught both in theory and practice in the schools, such as the Museum and Serapion of Alexandria, and also in other towns. The collected knowledge was of sufficient extent to be arranged in branches and under general principles to constitute a coherent ($\kappa\alpha\theta'\epsilon\iota\mu\omega\nu$) science. Books had been written, chiefly recipe-books each dealing with a special branch and preceded by an appropriate theoretical introduction. These were deposited and preserved in the sacred and the public libraries. The word theory, meaning 'looking on', was used to indicate thinking about the things observed in order to explain them, as is done in scientific research. In Latin the word 'theory' was translated by the word *speculatio* which was synonymous with it until a much later period, when it acquired a taint of gambling and thus was felt to be offensive in scientific circles. To make the teaching more useful and to induce the students to acquire skill in executing the recipes and carrying out experimental research the chymeutic laboratories were built and equipped with what, even today, is the basic apparatus of chemistry, such as mortars, balances, furnaces heated with wood or charcoal, other heating appliances such as water-baths (sometimes filled with aqueous solutions or oils), steam-baths ('*bains-Marie*' from the famous chymeutes Maria), sand and ash baths, ambixes or stills, beakers, funnels for filtering with cloth or through sand or earths and so on. These laboratories had their prototypes in the caverns and caves of the early metallurgists, the magicians and the prophets ($\pi\varphi\phi\hat{\eta}\tau\alpha$, professors).

D. THE ART OF MAZIKE.

Another aspect of the process of metalloiosis is that when the mixture is being liquefied, it shrinks and forms a pasty, more or less consistent, mass: as also did the *Chyma* when it was mixed, handled and kneaded. The matter in this condition was called *maza*, barley-bread. Thus the name Art of *Mazike* was also given to the process. As Stephanides states, it has also been called Moses' mass ($\mu\acute{a}\zeta\alpha\ Mω\acute{o}\epsilon\omega\varsigma$) from the old chymeutes Moses. This name, like that of the art of *metallike*, was little used.

E. HERMETIC ART. HERMES TRISMEGISTUS.

Another aspect of the Ancient chemical processes was the lucrative manufacture of imitations of precious stones made by coating stones of smaller value with various stains and even with genuine gold. The process consists in

preparing a suitable mixture of ingredients, painting with it the surface of the articles, and melting it by putting the articles in special furnaces so that the molten coating diffuses a little inside the surface and becomes firmly fixed. In the same way base metal could be covered with enamels and gold. The oldest known practitioner of this art and commentator thereon, who described this process in many books, was called Ἐρμηνευτὴς, Ἐρμῆς, *Hermes*, and his art, the method of *Baphai* (dyes or paints), was called *Hermetike*. This gilding of stones and base metals was made known in Egypt at the time of the Persian invasion, about 525 b.c., by a Hellenic chymeutes and professor who was known by the Persian name of Ostanes. Zosimus rightly considered this art a fraudulent one, because it was intended to give an object a golden appearance, while even in the best cases it was golden only at the surface. This art⁹ underwent a great development under the Hellenic mediaeval empire and its assumed inventor acquired such fame also in the West, that he was called *Hermes Trismegistos* (three times greatest).¹⁰

F. THE PROCESSES OF GOLD WINNING.

As gold is found in the free state in the mineral beds and is swept down by the eroding action of water to form the gold-bearing river-sand deposits, it was collected directly or after a renewed washing ; it was then carefully melted, alone or with the addition of substances intended to scorify and remove the earthy admixtures. Heraclitus, in 500 b.c., describes the process in two fragments as follows. “ The goldhunters dig out much earth and find little¹¹.—Gold is struck, washed, melted ; on a gentle and not intense fire it bakes together; when finished it is used for everything.” It is noteworthy that the Hellenic nation, although its gold deposits were not important, was never possessed by the mania for possessing gold, because it could get its wealth and power from its productive, artistic, and commercial activities.

In Egypt the mania for gold has always been prevalent. The Nile region, and also Nubia, provided large quantities of gold in sands and placers, which the Egyptian kings exploited as their monopoly. According to Agatharchides some mines were found near the Red Sea where the Nile turns north to the plain, and contained much mineral of a decidedly black colour with white veins. Geographically, south of Assouan in the E-W direction a chain of waterfalls separates Egypt from Nubia. The rocky desert highland, consisting of many plateaux, separated by deep valleys with mountains on the east border up to 2000 ft. high, extends towards the Red Sea. The treatment of this mineral by wet breaking and grinding in order to remove the pure gold in fragments or in the form of sand (*ψαμμονρυγική*, the psammurgy processes) seems to have started in

⁹ Stephanides, p. 27 (the Persian method of gold mining, as he calls it).

¹⁰ Hoefer, *Histoire de la chimie et de la physique*, p. 302—Stephanides, p. 44.

¹¹ Herman Diels, *Heracleitos van Ephesus*. Berlin, 1903. Fragment No. 22, Imitations, No. 20.

the 8th century B.C. These washed sands consisting of small pieces or tinsels of gold more or less contaminated with earthy matter (the *chyma* of gold) were transported to the capital for 'cooking' in order finally to remove any earthy admixture and to melt the pure gold into ingots suitable for making various articles (*καιρικαί*, the Kairikai processes). The prevalent policy is described by Zosimus in a letter to his sister¹².

"The whole kingdom of Egypt consists of the two arts, the *kairikai* and the sands . . . Not only the so called divine art but also the so called honorable arts and the hand-made articles have been given to guardians for keeping. Because the psammurgy was a property of the kings, should any priest or sage happen to have explained the old inscriptions or have knowledge by inheritance or inspection about the sand-washing he could not do so because he would have been punished, . . . the artisans of cooking as well as the experts of sand-washing . . . being conscripted by the kings to work in the royal treasuries in secrecy under a complete staff of very severe supervisors . . . People blame Democritus and the old writers for not writing anything regarding these arts except those so-called honorable. But they could not, because being friends to the kings and highly placed as teachers they never would publicly deliver lectures opposed to their will nor give the tyranny of the wealth to others. The Jews alone obtained by underhand methods some evidence and thus some descriptions appeared such as the topography of the gold mines by Theophilos and the work upon the furnaces by Maria. Concerning the *kairikai* neither Jew nor Hellene has at any time written . . . Only Democritos made suggestions in his treatise, and his suggestions were engraved upon their columns in the recesses and in the darkness by means of their symbolic characters, both the *kairikai* and the chorography of Egypt, in order that, should anybody have had the courage to penetrate into the recesses and the darkness to the faulty indications, he could not find a solution to the characters even after such boldness and toil . . . But when the inspectors were prosecuted by the former great men . . . for envy and to save their existence they hid the natural process and gave out to their priests their own unnatural one . . . and even if they obtained offerings they did not fulfill the . . . promise . . . And when the destruction was complete they flattered the remainder of people telling lies as from dreams . . . and the voluptuous miserable and ignorant people were delighted."

Plato, after visiting Egypt, wrote: "Always fond of money, the Egyptians resort even to treachery instead of to knowledge." Also the word *αἰγυπτιάζειν* denoted 'deceiving like the Egyptians'.

This necessarily fragmentary translation of the manuscript, as published by Berthelot and later by Stephanides, illustrates both the attitude of the Hellenic people towards the Egyptian frauds and the pitiful condition of the existing chymeutic manuscripts, due to defective copying and unconscious additions foreign to the originals. Nevertheless Stephanides and others have furnished much information that enables us to form an idea of the importance

¹² Stephanides, pp. 19-22.

of this art and the contribution offered by Hellenic men of science and their technique to the development of these processes.

The roasting process was carried on in the sanctuaries to which the sands or *chyma* produced by the washing-process and consisting of more or less pure gold were transported. Very intimately mixed earthy substances which could not be removed mechanically were removed chemically as slags. According to Agatharchides and others a mixture of the sand¹³, with definite proportions of lead, salt, tin, and barley bran, was roasted in a flat crucible during five days and nights to remove all added substances and leave the pure gold behind. This method must have been of Hellenic origin, as, according to the information furnished by Zosimos, Democritos suggested it and Stephanides writes that old writers call it 'the Egyptian method' or 'that of the Hellenic Jews of Egypt'. The date of the establishment of this art is placed by Stephanides in the years 718 or 525 B.C., an epoch of advanced metallurgy in the Hellenic provinces, whence lead and tin were exported to Egypt and where the cupellation of lead to liberate the silver was fully developed. The duration of the roasting for five days and nights points to the great number of operations carried out and is connected with an Egyptian religious belief connected with the times of flooding of the Nile.¹⁴ As to the process proper, we see that the salt was the fluxing agent assisting the formation of a slag from the earthy substances and the metallic oxides formed. The barley bran would furnish the necessary vapour, and the resulting charcoal would reduce any other metal present and retard the oxidation of the added lead and tin. Molten lead extracts the gold and eutectic alloy of lead and tin retains the gold dissolved at a rather low temperature in order to permit the slags to solidify first and be removed. The lead and tin were then removed by cupellation and the pure gold was obtained. Many important details of this process are wanting but it is certain that during roasting many additions were made, for Zosimos writes: "According to the testimony of Democritos this man (Ostanes) did not use (for his coatings) the additions and roastings of the Egyptians but he painted the outside of the substances and by heating he drove in the drug." In any case it was known that the gold existed dispersed in pure metallic condition in the mixture used and no idea of producing it by transmutation of base metals existed. But when, for want of the proper mineral, the recipes sold by the priests failed to produce gold, the assistance of the natural powers was implored by appealing to the demons and by other mystical, magical, and sorcerous operations, and the necessarily ensuing failure was regularly attributed to some omission of the experimenter. Zosimos disapproved all these appeals and

¹³ Stephanides, p. 23.

¹⁴ The Egyptians had adopted very early a year of 365 days consisting of 12 months of 30 days each followed by a series of 5 days (corrected later to 5½) which according to Diodoros were celebrated for the birth of one God each from Isis and Osiris. Arnold Reymond. *Histoire des sciences exactes et naturelles*, Paris, 1924, p. 9,

incantations by saying : " The intellectual man who knows himself, must not try to obtain anything by magic,—nor to enforce the necessity but to let things be as they are by nature and judgment." Nevertheless, many frauds were in use. Not to mention the superficial coatings made from gold and many compounds imitating the colour of gold and precious stones, we find in a papyrus of the 3rd century B.C. (found by Maspero in Thebes of Egypt and written in Greek) various recipes for the use of base metals to make alloys to simulate gold and imitation jewellery, and also for the colouring of the metals by various methods.

The gold-making process described has undergone many stages of development. Democritos must have recorded its final state. This scientist may have been the famous Democritos of Abdera who prior to 450 B.C. was in Egypt, where he resided for 7 years. He could have learned the method of coatings from Ostanes who went to Egypt after its conquest by the Persians. The young scientist must, however, have been highly esteemed by the Kings and was commissioned to make a study of the entire gold-making industry and to systematize it ; this task he fulfilled and his suggestions were engraved on the columns of the sanctuaries, in the recesses and in the dark, and were kept secret by the priests. Concerning the whole life of Democritus, little is known, but the Hellenes may well have been vexed that he displayed such a friendship to the Egyptians and that he did not disclose anything about the psammurgy process and the cooking of gold. Thus he may have left Egypt without money and then devoted himself to modelling and teaching his famous philosophical system, which shows that he was a most distinguished scientist and chemist.

G. THE CHYMEUTIC KNOWLEDGE.

In 321 B.C. the Hellenic town of Alexandria was founded as a new commercial centre for the eastern Mediterranean world and it also became the centre of Hellenic culture. Here chemistry rose to the rank of a science. Although the concept of *metalloiosis* and its various branches *metallike*, *mazike*, *hermetike*, and *chymia* were all products of the Hellenic philosophers (chemists), yet since the term Chymia was preponderant in Egypt, the land of the famous gold-chyma, the art of producing new substances by metalliosis was given the name of the Art of Chymeutike, a name which remained in use with the Hellenic people to denote the true and genuine hellenic chemistry as long as an Hellenic empire existed, viz. until A.D. 1453.

Alexander the Great entered Egypt without difficulty, having been welcomed as its deliverer from the Persian yoke. He found there a busy Hellenic population which had accumulated through centuries as residents, visitors and invaders, and from 525 B.C. had assumed a great importance. It propagated the Greek language, constituted Greek-speaking native communities like that of the Hellenomemphites and others and even took part in the political affairs of the country. Thus when Ptolemy, one of Alexander's generals, became ruler of this

part of his dominions he found the ground well-prepared for the propagation of the doctrines of Aristotle, the great teacher of his master and himself. Aristotle, like Hippocrates and Socrates before him, held the treasures contained in the writings of the older sages in great esteem and was ready to adopt what was well said and respect what was not ; so Ptolemy also, not wishing to be thought to be condemning the older opinions by default, made as complete as possible a collection of earlier and contemporary writings and deposited them in libraries, for use of the scientists of all times. He also established schools of all kinds and grades, the high schools of the Museum and the Serapeion being the most famous and forming the models for all later Academies and Universities. Thus Ptolemy concentrated in Alexandria the whole of the Hellenic intellectual movement for a period of over 300 years, the era of creation of the applied sciences. Chymeutike had been formulated into a coherent system, taught, not only theoretically but also practically, in the chymeutic laboratories, which were well equipped, as already stated above. Many books were written, the contents of which were for the most part practical recipes, the whole material being divided according to the various groups of subjects comprised in Chymia, with a convenient theoretical introduction.

All this accumulated knowledge perished under the Roman conquest and most of what has come down to us has been preserved by the pious care of the Hellenic people ; to this must be added some more or less correct Latin, Syriac, or later Arabic translations either from originals or more frequently from more or less faithful copies. The Roman conquest was detrimental to Hellenic science because the Romans did not care for science and were interested only in practical and engineering occupations and politics¹⁵. The Romans even despised pure science and Cicero praises them in that, thank God, they are not like the Hellenes and know to limit the study of mathematics to their useful applications. Thus Hellenic science remained foreign to the mentality of the occident. Thus the Romans took no interest in the chymeutic science ; they used only the older chymia recipes, and on various occasions they destroyed by fire the chymeutic books from which their Hellenic subjects continually refreshed their traditions, sharpened their practical abilities and gained wealth and power. To this neglect was added the religious fanaticism of the Christians against the pagans, which was used by the Roman emperors, who in their attack upon Christianity, represented chiefly by the Hellenic element, found occasion to attack Hellenism as a whole. By this time the Roman empire was beginning to decay and the Hellenes were organized to regain their liberty. In Egypt the Hellenes made a formal insurrection, but unfortunately the emperor Diocletian succeeded in concentrating all the military forces and powers of intrigue of his empire in a last achievement by drowning this revolt in Hellenic blood and setting on fire

¹⁵ Arnold Reymond, *op. cit.* p. 91.

what remained of the books of science and technology in the Greek language, in order to deprive the Hellenes of the means of winning wealth and power¹⁶.

But the decaying Roman empire could not long retain the integrity of its government and very soon (A.D. 303) the Oriental part of it containing the Hellenic element became autonomous, with Christianity as its official religion. Its capital Byzantium was rebuilt according to a new and magnificent plan, its name was changed to Constantinople and it became the new centre of the intellectual and industrial movement of the Hellenic nation. The Hellenic chymeutes, who had already been reconciled with Christianity, were now free, and started the work of restoration of chymeutike, which then existed only in the tradition of the artisans, in some copies and some bad translations of its texts. Their books were more or less affected by religious mysticism and the tendency to popularize the natural phenomena by comparison with the proceedings of human life. A great confusion was prevalent which they tried to amend, but with small success, for it has persisted even up to our own time. Zosimus and Stephanus write : "Mythic Chymia ($\chi\etaμία$) is confounded by the multitude of expressions." Olympiodorus later on writes : "By the multitude of the propositions and the infinite number of expressions the man approaching this art becomes confounded."

The concept of the four elements is accepted in its Aristotelian definition. Fire, air, water and earth are considered to represent properties belonging to the one common underlying principle ($oύσια$). These, according to properties recognizable by touch, are dry-hot-moist-cold, and each element is characterized by two of them, so that a circle can be drawn as follows : fire, dry-hot : air, hot-moist : water, moist-cold : earth, cold-dry. All bodies are formed from these four elements in varying proportions. The name four-bodied matter was formulated ($τετράσωμος οὐλη$). Fire was then given a special importance because it was said to organize the conditions of the others. But in this way no satisfactory system could be formed to explain the great number of known substances nor to account for the processes of metalloiosis ; and a further view of Aristotle concerning the distinction between the natural and the artificial or manufactured bodies was made use of.¹⁷ The natural bodies, forming the various genera like wood, wool, copper, etc. possess an innate principle of movement and bearing, whereas the artificial bodies or articles made from them contain the primary substance to which the special form of the species has been given, like bed, garment or statue, etc. but have not in themselves the tendency of creation but receive it from outside and from others. After they have received their proper form they are not called by the name of the substance they have been made of, i.e. the bed, not wood ; the garment, not wool ; the statue,

¹⁶ C. J. S. Thompson. The Mystery and Romance of Alchemy and Pharmacy. London, 1897, p. 47. Also in all Encyclopaedias.

¹⁷ Stephanides, *op. cit.*, p. 84 (from Synesios. Coll. p. 62).

not copper ; etc. Thus the distinction between genera and species was made. The genera were the simple *protourgon* or first-made bodies possessing an innate faculty of change, as iron, copper, lead, etc. The species were various forms of them made by changes due to corruption, as with admixtures. Yellow or red ochre are species of the genus iron, litharge and minium are various species of lead, copperas and scales of copper are various species of copper, etc. According to the chymeutes Anepigraphos¹⁸ in the 7th century the genera preside over the species and become mixed (to metallic alloys) in accordance to their original (first-made) and crude principles or natures. The species, as a result of the process of their production from the genera, are hindered from union on account of the admixed substances. The genera become corrupted by admixtures and form species (or new bodies) but each of the two mixed bodies conserves in the new body its nature and existence. Thus it becomes intelligible that by the disappearance of primary substances compounds are formed and by the disappearance of compounds the primary substances reappear. It is noteworthy that Berthelot failed to recognize the meaning and importance of these fragments of Anepigraphos which contain a thermo-chemical distinction between the exo-thermic process of combination of chemical elements, the corruption of the genus to form species, and the generally indifferent behaviour of neutral compounds, the species, leading to equilibria. He considers these opinions "de pures subtilités que l'on n'a pas cru utile de traduire" (*Coll.* p. 408). Stephanides recognized their great value (*op. cit.* Note 2, pp. 32 and 70). Demokritos said that the chyta become mixed and united by natural sympathy and substantial affinity, thus distinguishing between the mutual sympathy of the metallic substances to form alloys and the affinity to unite into compounds. To become changed the substances must come to an intimate contact. This is accomplished first mechanically by grinding to a chyma, mixing and then bringing into a liquid state by dissolving or melting. The cold mixing is done in a mortar of stone or lead with common or strong and sharp waters. The solutions were divided into limpid and turbid according to the size of the particles. The heat treatment was executed by putting the mixture upon a metallic leaf, often covered by an inverted half bottle so as to be protected from air and dust, and suspending it over a water-bath, bath of some other liquid, or sand-bath. Melting was performed in crucibles heated in proper furnaces. The crucibles were either deep or shallow, and many types of crucibles and furnaces existed. To condense the vapours produced, the ambix (still-head) was constructed very early and won a great importance. Christians made a computation of the number of possible combinations of processes and found 264, indicating thus the efforts made towards classification. The skilful execution of the processes was called the *economy* of the substances and the completion of the task, the *metalloiosis*. A pair of different substances suitable to be combined were also called by others male and female, possessing their own soul and combining to produce the child.

¹⁸ Stephanides, *op. cit.*, p. 32.

The chymeutic embryo with its proper soul grows, and with the fullness of time comes irresistibly out and is nourished by the waters instead of by milk. Insoluble or infusible substances were considered to be dead, without soul. In order that they may be liquefied they must receive a soul from a third substance, the mediators. Some were helpful to fuse, others acted as ferments, others as seeds to destroy supersaturation, etc.; they represent the catalysts of our times. Liquid mediators were the waters, especially *aquae fortes* or sharp waters (oils of nitrum, comprising acids and bases), the mythic waters of Christianos. All mediators were very early comprised in the concept of the almighty substance of Ostanes. The intensity and the quantity of heat were evaluated by kind and quantity of the substances burned to provide it. Other processes developing heat, such as the slaking of lime, were also known.

As regards the practical knowledge gained by the scientific researches catalogued above, Stephanides gives a fairly complete account of the mass of observations regarding the geological sources of the waters, their qualities and their use.¹⁹ Hippocrates (414 B.C.) knew that the quality of the waters could be tested by weighing on balances and later on with the hydroscopion or densimeter. This test was used along with a series of others, because waters of equal weight could have a different action on the organism. The physicians distinguished between potable, healing and deleterious waters. Also for the various arts, inorganic and organic, the quality of the water was examined and a full scheme of tests was devised. The red wine test is very near to a volumetric analysis. Soft water is coloured red with the first drops of red wine added, whereas hard water turns first green and with more drops becomes red.

A very striking example of the application of deep observation and experiment is given by the preparation of wine, according to Dem. Kissopoulos²⁰. The care taken at all stages of the preparation is noteworthy. To prevent wine from turning turbid it was pasteurized by filling in pottery jars, closing their mouth airtight with leather and heating gently in the waste smoke and gases produced in the bath and kitchen heating systems. This heating also promoted ageing: Galen assumed that it was not the soot deposited upon the jars but the heat that brought the beneficial effect.

Constantinople and other towns of the Hellenic empire became famous for their artistic and industrial arts. The practical recipes for goldsmithing, jewellery, colour-making, pottery, glass-making and glass-working, encaustics, mosaics, stones coloured by heat, dyed and printed tissues, leather, silk, cane-sugar, etc., all so-called chymeutic arts or arts of Chyme, were remarkable. The chemical industries produced the famous Hellenic fire of the chymetes

¹⁹ Stephanides, 6th contribution *On Water*, pp. 126–183, also 5th contribution *On Chemical analysis*, pp. 116–125.

²⁰ D. Kissopoulos. *H'οινολογία τῶν ἀζχαίων. Χημικὰ χζονικά.* 1950 ἀριθ. 10-11. Αθῆναι.

Callinicos in the 6th century, which for centuries saved the empire from sea-invasions and which in the form of the fireships of Nicodemos and their able use by Kanaris in 1821 founded the liberty of the present Hellenic kingdom.

This is the sad story of Chymeutike, the real and genuine chemistry which was developed from the basic concept of *metalloiosis*, change in its broader sense, by means of the scientific and industrial research. It is noteworthy that the names of two of the pioneering intellects in old natural philosophy, Heraclitus and Democritus are connected with its development and that their general principles, as shown by the author, are so well adapted to the newest conquests of our science, because they are not *a priori* conceptions or mere speculations, as it is generally supposed, but products of the purest scientific research. It is also obvious that Hellenic chymeutike has no connection whatever with Alchemy and that the name of alchemists cannot be used for the Hellenic chymeutes.

REVIEWS.

Aspects de l'Alchimie Traditionnelle. Preface de Eugène Canseliet. Textes et Symboles Alchimiques suivis de "La Pierre de Touche" d'Huginus a Barma (1657). By RENÉ ALLEUL. Pp. 238. Paris : Editions de Minuit, 1953. Price about 20s.

THE very interesting and erudite preface by M. Canseliet, explaining the scope of this remarkable book—the author is a young man in his middle-twenties—gives to the English reader the typical French approach to the subject of alchemy. It is taken for granted that the continuity of this tradition has never been broken, yet one may say that the last student of alchemy in Britain, to whom the subject was still "alive" and who still had a profound knowledge of the traditional literature of the subject, was Elias Ashmole.

In the first part of his book M. Alleul gives us examples of his wide knowledge of ancient Oriental, pre-Greek and Greek mythologies, the symbolism of which he uses to attempt an explanation of what is really meant by alchemy, and to explain how the student should proceed to acquire 'alchemical knowledge', which is not for the many, but only for the few. Alchemy, according to M. Alleul, belongs as much to the history of religion as it does to the history of science. How shall the neophyte find his way through a labyrinth of obscurities and seeming contradictions? "La perturbation de l'équilibre du mécanisme logique de la conscience profane de l'état de veille semble donc constituer le principe didactique de l'alchimie". In other words, what is needed, the author goes on to say, is something like the "satori" of the Zen Buddhists, a 'psychic explosion', to use a modern phrase borrowed from the school of Professor Jung, which "opens" the intuitive faculty of the student and gives him a superior awareness of the nature of cause and effect. But, it is permitted to ask, does the 'satori' accomplish this? The Oriental imaginative experience is profound, but infinitely more limited than the highly intellectual and diverse experience of the Western mind which is dominated by different and often antagonistic streams of thought. The Christian monks in the seclusion of their cloister had no need of this kind of awakening, and nowhere did alchemy ever flourish as it did in the mediaeval monasteries. One may even say that alchemy is one of the special graces of Christian civilization, even though one may readily admit that the roots of this science were planted deeply in other soils.

To substantiate his point of view, that we must go back to systems of religion whose sources have not undergone the corruption of, for example, the later Greek mysteries, the author gives us a most interesting interpretation of the mysteries of Samothrace, of the Kabiroi, where smiths and metallurgists are supposed to have contributed to the formation of an alchemical tradition allied to the craft of the priests. It is suggested that the three Kabiroi are related as follows: Axiokersos represents Apollo-Helios, Axiokersa the moon, whereas Axieros is the complete Hermes, the alchemical hermaphrodite. The fourth Kabiroi, Kasmilos, is the symbol of the Hermetic essence, of harmony, of gradation, it is not a symbol of the attributes of the first three Kabiroi. But, one may ask, is not the author confusing fire-theurgy with what we understand the term 'alchemy' to mean? Did these metallurgical mystics really practise alchemy as we understand it? Rather does the origin of alchemy lie in

those sophisticated civilizations where a symbolical system of numbers was developed, based on the *measure* of the forces of nature, as the researches of Kraus and Stapleton have shown. The author, however, seems to us to approach firmer ground, when he identifies the Kabiric triad with the constellation of the Great Bear, an important symbol in the tradition of alchemy.

The second part of the book, alchemical symbols, is devoted to an explanation of these symbols as they are related to religious symbolism, and here the author exhibits a profound intuitive knowledge united to precise logical thinking. The third part, texts and documents, gives little-known excerpts from a number of authors, including some Chinese texts, which serve to illustrate the point of view set forth in the book. (The third edition of Huginus a Barma, incidentally appeared in 1780, one of the very last genuine alchemical works to be published in Europe.) The book ends with a list of alchemical symbols, graphically portrayed, with their meaning, and this is followed by an excellent bibliography.

Altogether a very stimulating and suggestive work, written by a scholar who has an enviable knowledge of the literature of alchemy. G. H.

Enstehung und Ausbreitung der Alchemie. By EDMUND O. VON LIPPMANN.

Vol. III, Edited by Dr. R. von Lippmann, Verlag. Chemie. GMBH. Weinheim/Bergstr., 1954. 166 pages.

VOLUMES I and II of E. O. von Lippmann's work on the origins and the propagation of Alchemy are classics. Students of alchemy will be most grateful to Dr. R. von Lippmann for having prepared an edition of the third volume which was ready for the press in 1940, shortly before Professor E. O. von Lippmann died. The text has been revised and enlarged by Professor J. Ruska (d. 1949) and by Professor W. Hartner.

The third volume is alphabetically arranged, and may thus be used as a work of reference. The several articles do, not however, pretend to exhaust their subjects ; they mostly represent Professor E. O. von Lippmann's last gleanings on subjects he had already dealt with in the preceding volumes. The author's vast knowledge of classical, oriental and early mediaeval sources makes these notes into a most valuable and interesting source of additional information. The articles dealing with metals and their planetary correspondences deserve special mention. C. H. J.

Deux Logis Alchimiques. By EUGENE CANSELIER. Pp. xii+156. Paris : Jean Schmit, 1945. Price about 20s.

THIS important book, written by the *doyen* of the students of Alchemy in France, is difficult to obtain, as only a small number of copies were published. The author has an extraordinary knowledge of the literature of alchemy ; he has catalogued all available manuscripts in France, written by alchemical authors, many of which have escaped the editors of the 'Corpus'.

The author describes two mansions whose owners were greatly interested in the Great Work and we see here how, in former centuries, alchemy was a 'way of life' for many people, a way of life that seemed to have combined a religious faith with scientific experiments, the experiments, of course, having only to do with an attempt to discover and imitate the process of creation. Very often a wealthy 'adept' would build himself a house and embellish it with alchemical symbols, decorating his rooms and adorning the façade of his front wall with curious figures carved in stone.

The first *logis* refers to the former Villa Palombara in Rome, of which only the stone door-frame, today in the Place Victor Emmanuel, survives. This door-frame, as visitors to Rome will remember, has incised on it, on all four sides, alchemical symbols, and the frame itself is surmounted by an alchemical symbol in stone. The author has brought to light a mass of information about the former villa and its owners, explaining the symbolism in detail with a great wealth of reference and archeological research. The fifteenth century Chateau of Plessis-Bourré, still standing, but whose owner evidently refused the author permission of entry, is the second *logis*. After giving a most interesting historical account of the builder of the Chateau—Jean Bourré, who held high office under Louis XI—the author describes the symbolical paintings on the ceiling of one of the large rooms, these paintings fortunately having been photographed some years ago. Again we have here a great wealth of reference which is a delight to the student of alchemy, and there begin to arise before us those two amazing centuries, the fifteenth and the sixteenth, when the imagination of France was dominated by the symbolism of the Great Work.

G. H.

Raymond Lulle et l'Alchimie. Introduction au Codicille aves notes et Glossaire. Par ROBERT AMADOU. Pp. 76. Paris : La Haute Science, 1953.

Le Codicille de Raymond Lulle. Nouvellement traduit du Latin. Par LEONCE BOUYSSOU. Pp. 175. Paris : La Haute Science, 1953. Both works together about 17s. 6d.

In the first book, a very scholarly work with a good apparatus of bibliographical foot-notes, the author discusses the question whether or not the "historical" Raymond Lull was in fact the author of the various alchemical treatises attributed to him. Passages from his writings are quoted which are entirely unfavourably disposed towards the subject and the conclusion reached is that, although Lull knew about alchemy, there is no evidence that he either practised it or wrote even one alchemical work. The author of the works attributed to Lull used the latter's name to give these works prestige and here he followed a customary practice of the later middle ages in foisting alchemical literature on to the names of the great personalities of the age. It is therefore the pseudo-Lull who is the author of the Corpus Chymicum Luleianum, and it is this alchemist who is responsible for the myth that the 'historical' Lull was an alchemical author. This fact does not detract from the importance of the writings that compose the corpus as outstanding products of European alchemical literature ; M. Amadou, in the second part of his book, gives us a very interesting introduction to the understanding of the 'Codicille' of Lull, which is the most important work of the Corpus, and this introduction is followed by a useful glossary of alchemical terms.

The careful translation of the 'Codicille', based on the Latin original published at Cologne, 1563, places us under an obligation to both translator and publisher. As M. Amadou says in his preface to this work, here we have an interesting landmark in the history of ideas, especially interesting to English students because so much of the English alchemical tradition seems to derive from the writings of Lull. The Latin used in the text of the 1563 edition is difficult and often obscure, rather as if the writer had been unable to find a proper medium for the transmission of his ideas than that he used a deliberately indistinct style in order to 'throw a veil over secrets not for the profane', as has been alleged. The translation draws the attention of the reader to the idea

that the difficult Latin of the writer of the 'Codicille' was written by an author whose mechanism of thinking is not only removed from ours by five hundred years, but whose concepts often seem to be based on a different tradition; in this case, possibly, the Arabic and mediaeval Jewish scientific terminologies were the foundations on which he based his attempt to describe the alchemical process.

G. H.

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